SCIENCE.

FRIDAY, AUGUST 3, 1883.

THE U. S. NATIONAL MUSEUM.

II.

In a former number we reviewed some of the important principles of general classification suggested by Mr. Goode's plan of the National museum. We resume the topic to discuss some of the salient points in the minor groupings of the same scheme.

Section iii., 'natural resources,' i.e., 'force and matter,' appears to be out of place. Certainly these are primary subjects; and we cannot, as a merely practical matter, understand why the study of physics and chemistry is placed after that of the earth, which is to be treated of earlier under the separate heads of 'cosmology,' 'geology,' 'physiography,' etc., in section ii. Imagine a person trying to learn something of the relations of force and matter to the history of the development of the earth and its topography as it now appears, and having in view the applications of these studies to the explanation of some of man's migrations or racial differences, or to any other anthropological problem which might reach back to primary connections. Is it supposable that his inquiries would be facilitated by placing the collection in such relations to each other as completely to cover up and invert their natural relations and logical order? Or is it probable that the mind of the visitor would be more enlightened by getting his information about the relations of the elements after he had passed through celestial and terrestrial physics and chemistry, and all the applications of these to the history of the development of the earth?

We can readily picture to ourselves the confusion which might be generated in his mind, and the discovery he might make of the necessity of reviewing all he had passed over before; but we fail in attempts to imagine the advantages of this inversion. We cannot, therefore, understand the considerations which induced Mr. Goode to adopt this method of arranging the sections, nor why he did not place natural resources first, and man last, in his natural history division; for that is what the first three sections really constitute when taken together. They would then have stood in approximately natural, and certainly respectably logical, relations to each other.

We should then have had in section i., physics, chemistry, and all the mineralogical, botanical, and zoölogical collections as introductions to the study of section ii., where the principles of science learned in passing them in review would be found of essential assistance in understanding the earth, with all the topics of cosmology, geology, etc., whether presented, as Mr. Goode proposes, solely as man's abode, or in its more natural relation to the universe as a planetary body. The last seems to us the preferable because more natural mode of presentation; and the author shows this by bringing in cosmology. This, if at all effective, must show that the earth is a planet primarily uninhabitable by man, and evolved without reference to his existence, conducted in its career by cosmic forces uninfluenced by his presence, and, in all likelihood, destined to become unfit, in course of time, for his existence.

After the earth as man's abode had been passed through by the visitor, we could readily conceive of his being all the better prepared for the understanding of section iii., 'the natural history of man and his adjuncts of all kinds.'

Passing over section iv. ('the exploitative industries') and section v. ('the elaborative industries'), which together constitute what appears to be a second grand division of the museum representing the purely industrial side, we come to section vi. In this section are included foods, and drinks in their final stages of preparation for the use of man, narcotics, dress, buildings, furniture, heating and illumination, medicine, hygiene, transportation. All

of these are supposed to have a more direct relation to the physical condition of mankind, either from their nature, or in the peculiar stages of their manufacture which makes them admissible to the cases of this section.

Section vii., 'social relations of mankind (sociology and its accessories),' is to be an exposition of the appliances and methods made use of by man in his social relations, communication of ideas and their record, trade and commerce, societies and federations, government and law, war, ceremonies.

Section viii., 'intellectual occupations of mankind (art, science, and philosophy),' is to show the existing intellectual and moral condition of man, and the most perfect results of human achievement in every direction of activity. Its topics are to be games and amusements, music, the drama, the arts, literature, folk-lore, science, philosophy, education, and climaxes of human achievement.

The sixth to the eighth sections contain the special topics which can be used to illustrate the results of the intellectual progress of man more completely and directly, perhaps, than the industries, in sections iv. and v.; and these are accordingly placed in a succession leading naturally to their culmination in the topic which terminates section viii., and is at the same time the sixty-fourth and last of all of the topics. This terminal topic is to be an exposition of the most remarkable achievements of man. The separation of this from the final topic of section i. ('man in his individual manifestations, representative men, biography') shows, that, though Mr. Goode has kept in view the key-note of man's progress in civilization, the development of the individual, he has nevertheless either failed in seeing, or considered of subordinate importance, the racial peculiarities and advantages of which the representative man is necessarily only the concentrated or focalized expression.

In fact, this want of what we might call psychological insight is apparent everywhere; and throughout the scheme the race is subordinated to the notion that man should be presented and considered as a whole, whether in the development of the topics separately, or the purely comparative arrangement of the sixty-four topics themselves as assembled in the different sections of the museum. In section i. man is treated of 'psychologically as a unit;' and it is only in the second topic of this section, where the natural relations of men force the treatment to stand upon a racial basis, that we find this policy even apparently abandoned. We say apparently; because, as we understand it, the effort here will be not to show the historical or physical development of the races, so much as to contrast them side by side and exhibit the characteristics of each race.

In all its parts, the arrangement is based in each topic upon a comparison of the work of different races; and the objects used for these purposes must be withdrawn from their natural associations in other collections, and their significance in the history, physical and psychological, of any particular race, be sacrificed.

This is the method of comparative anatomy, and has certain obvious advantages for the study of anatomy if it is confined in application within the well-defined limits of any one type of plants or animals; but it is liable to lead to serious errors when carried beyond these limits. The dismembered organs or parts, though similar, are, when found in distinct types, unquestionably often distinct in origin. The comparative method necessarily cuts across the natural order of things in their relations to time and to the successive stages of their development: and this is an obvious defect, which, when applied to anthropological collections, is destructive of all natural conceptions as to the way in which modifications and changes really arise or flow out of pre-existing localized or racial conditions.

Anthropology as a science is essentially concerned in tracing the history of different races of men: it clings to the race as the safest basis of classification at present existing, and it is the test by which all general conclusions with regard to the nature of man and the evolution of civilization are judged. A museum of anthropology departs widely from this basis

and true scientific conservatism when it assumes the task of harmonizing the psychology of all the races of men, especially in the present almost unexplored condition of this field in savage races, and when it declares that it can present a true picture of the existing condition of man by the method of general comparison of things whose connections, as they stand side by side, are obviously unnatural.

The presentation of the results of achievement in all directions, as attained by each race or natural association of races, could not have been open to such serious objections, would have been far more effectual, and more in accordance with the principles of modern classification and the practice of museums of anthropology. It would, at any rate, have retained the collections in what are known to be their natural relations; such a presentation could not have failed, therefore, to meet the wants of the future and the demands of the present in a more effectual way than by any artificial classification, whatever its convenience.

We do not think that the industrial side would have suffered from this policy, but, on the contrary, we think its subjects would have greatly gained in interest from being shown as developed by the different races; nor do we believe that such a plan would have demanded more room than the present plan, required any more duplicate collections for its proper illustration, or yet have greatly increased the difficulties of the classification of topics which Mr. Goode has so ably handled in his scheme.

The comparative method could then, if deemed necessary, have been resorted to as a crowning effort to show, side by side in a single collection, the ultimate achievements and results attained by each race, how far it had been able to advance in civilization, and what influence, if any, its finest work had had upon the existing conditions of that civilization. Such a summary certainly could be so limited by judicious selection as to be brought within the mental grasp of the intelligent and diligent student; whereas a definite conception of Mr. Goode's sixty-four topics presupposes mental powers of a titanic order. In fact, the graphic picture of civilization which they will present will, from their number and mode of arrangement, be necessarily heterogeneous, — an improvement, no doubt, on general notions in being composed of objects instead of individualized mental conceptions, but certainly not capable of giving the harmonious effect which the author aims at producing.

The National museum is, however, to be not only the representative educational museum of this country, but is also to be combined with departments of research. We have, therefore, to consider the probable influence of the museum of education and its collections upon the departments of research, bequeathed to its care by the Smithsonian, as well as those likely to come under its influence in the future. These last collections might, perhaps, be safely left to themselves; but it must be remembered, that, though at present secure, they will eventually obey the law of attraction, and their curators must begin immediately to take an active interest in the collections which are to represent their achievements before the country at large, and the relations of these departments to the prospects of investigators.

At present the departments of research and those of education are not only under one head, but the subordinate offices are also united in the same persons. Under these circumstances, we view with apprehension certain tendencies, which are evident in the pamphlet before us, and especially the prominence given to the industrial sections. Their present mode of arrangement and ideals do not definitively shut out all possibility of co-operation with business; on the contrary, if we understand certain passages in Mr. Goode's pamphlet, this co-operation is invited, and some firms are already providing the cases with collections of industrial products. We know that science is not the weakest now in the National museum, and our fears will probably highly amuse the officers of the industrial sections; but nevertheless, we cannot see what is to prevent enterprising firms from presently finding out the value of these departments as advertising mediums, and being

aggressively if not successfully generous in supplying their wants with expensive gifts, accompanied by their business-cards. The fertility of the imagination in the construction of wedges may certainly be counted upon as quite equal to the opening of any cracks which may present themselves; and we think it would have been far more prudent to recognize and provide for these dangers, however remote they might be considered.

We are, of course, conscious that the joining of hands between science and the industries is the general drift of the tendencies of the day, especially in this country. That this will elevate the industries, we have no doubt; but that it will also elevate the ideals of science, we do not believe. How will the future director, however scientific, avoid the necessity of becoming, before the government and the country, the representative of great commercial and industrial questions and interests, and be in danger of having his interests and his thoughts drawn into the vortex of such affairs, to the exclusion and neglect of the purely scientific aims and objects of the museum? We do not claim that this will be sure to be the case, but simply that we do not see how he can avoid the natural results of his position at the head of the great industrial museum of the country.

Mr. Goode's pamphlet also contains other matters, which, when viewed in the light given by the past history of other museums, show the neglect of essential precautions. There is, for example, no provision for limiting the accumulations of specimens. On the contrary, overpowered by the wants of his world-embracing scheme, he appeals to public-spirited citizens to come forward and deposit their valuable and extensive private collections; and it is especially recommended that the officers, by a wise forethought, should encourage this propensity to the utmost.

Private collections have been made for the most heterogeneous purposes; and it is well known that their possessors usually demand, in return for their generosity in giving them, that they shall be kept together, or have a goodly proportion of exhibition space allotted to them. Such unqualified appeals, and the neglect of all other precautions [1] against the unlimited acquisition of materials, are entirely at variance with the selective policy previously announced, and a complete surrender of the principles which should govern a museum starting with a new ideal, and bent upon avoiding the errors of policy and the unnecessary burdens which had been previously and truthfully described by Mr. Goode as the greatest obstacles in the path of the older museums.

It does not require a prophetic eye to see in the near future, that assisted by the Fish-commission, the Geological survey, and other departments of the government, the business energy and liberality of the American citizen, the pride, energy, and influence of the present staff of museum, uncontrolled by any prudential considerations, and stimulated by the universal field they are required to cover, will heap up materials not only faster than they can be handled, but in such masses that they will become, as in older museums, serious obstacles to the progress of the museum of education itself, and be still more serious in their effects upon the museum of research. The resources of the National museum, however great they may be, will inevitably find themselves, sooner or later, blocked by these accumulations; and their care will occupy the time of the officers in an increasing ratio. Luckily for science, men in such positions have frequently found themselves unable to resist the suggestive seductions of research, and allowed collections to suffer while they studied; but many, too conscientious to do this, have been sacrificed to the mere preservation of materials, whose labors would have repaid the daily wages of many more lower-class laborers to any civilized government. Large accumulations, however, not only directly discourage the investigator by

[1] That we are not misrepresenting the spirit of the museum by this remark may be learned in Mr. Goode's own words: "The classification proposed should provide a place for every object in existence which it is possible to describe, or which may be designated by a name. When the object itself cannot be obtained, its place should be supplied by a model, picture, or diagram."

wasting his time, but their necessary preservation strikes at a still more vital point in using up funds which could otherwise be employed for the publication of the results of researches. They also equally interfere with the purchase of delicate instruments, the employment of labor to directly assist in carrying out the purposes of research, prevent the purchase of such specimens or collections as may be essential, and cut off opportunities for travel and study in other museums or parts of the world.

We think, therefore, that, while the National museum may open some paths to the investigator, it will neither directly do the very best work in this direction, nor give us any grounds for believing that it will introduce a new era of prosperity for abstract investigation. It will add one more to the useful scientific institutions of its kind, it will undoubtedly contribute to the progress of science by increasing the opportunities for employment and by the example of its officers; but it will not do much for them or for us in the way of an exalted ideal.

If the museum of education had been limited by a wise policy of selection in its accumulations of materials, and placed under a distinct staff, we could have made no such objections; then the practical objects of its existence would not have suffered, as they now surely will, from the psychological tendencies of the investigating curators; nor, on the other hand, would the investigators themselves have been distracted by having a double purpose in all that they were doing, and frequently obliged to sacrifice one or the other. We do not wish to imply that the museums should not be under one general head, and have all the benefits of mutual association, but simply insist that the ideals are quite distinct, and the officers should realize this by being under different regulations, and under a different government, in each of the two museums. The investigator cannot avoid placing on exhibition the record of his own and others' work; and he will find a thousand good reasons for crowding the cases with fine collections, because they are fine, and because they are important in research, or unique, or remarkable; and the educational idea will be subordinate or completely lost in such parts of the museum, so far as the average student is concerned.

The cost of the museum will be enormous; but if its lessons can be easily mastered by the average student, and in this case the student is the average congressman, he will not begrudge the funds which are necessary for its support. It must be remembered that these are keen men, quick to see the advantages of such lessons as the museum can teach them; especially if, like the library, it can make itself really useful to them, and keep up with the times by illustrating the new results of discovery and research in all departments of learning in an explanatory and popular way. We imagine that they will not be slow in calling upon the officers of the museum whenever they have need of their services, and that they will be rather disgusted if any of the requirements of research interfere with their desire for information.

While we wish the greatest success to the National museum and its energetic and deservedly popular director, and have the highest respect and friendliest feeling towards their undertaking, and a faith that they will finally work out a better result than is promised, we think that neither this faith nor their great scientific achievements, of which we are justly proud, nor the liberality of the government, can entirely make up for the absence of the public recognition of a more purely scientific ideal in *our* National museum.

KINETIC CONSIDERATIONS AS TO THE NATURE OF THE ATOMIC MOTIONS WHICH PROBABLY ORIGINATE RADIATIONS.[1] — II.

HAVING now sufficiently cleared the field of inquiry by this preliminary discussion, let us consider the proposed hypothesis somewhat more closely, both as to what it is precisely, and as to how far it is in accordance with the phenomena. The whole outcome of Lockyer's investigations, to which we have referred, leads to the conclusion that atoms of the chemical elements are complex bodies, all of which

[1] Concluded from No. 24. See also *Proc. Ohio mech. inst.*, ii. 89.

are formed of ultimate atoms of the same kind; so that, on this hypothesis, there is but one kind of substance from which all others are compounded. Chemical atoms might be compared to a chime of bells all cast from the same material, but each having its own special series of harmonic vibrations.

A necessary result flowing from this hypothesis would be, that the atomic weights should all be exact multiples of some fraction of the atomic weight of hydrogen, which would include Prout's hypothesis as a particular case. The experimental data are, perhaps, not yet sufficiently precise to enable us to obtain a trustworthy result as to the probability of the truth of Prout's hypothesis; yet Clarke's [1] results as to the atomic weights seem to show that the hypothesis has a high degree of probability.

If the chemical atoms of all bodies are assumed to be formed of ultimate atoms, which are in all respects equal and alike, this hypothesis furnishes a basis for investigation at once definite and simple, some of whose consequences we shall now endeavor to show to be in accordance with experimental facts.

We wish, in the first place, to show that this hypothesis will make the temperature of a gas proportional to its mean kinetic energy. A chemical atom may be assumed to be a perfectly elastic body, as its deformation is assumed to be extremely small. But according to the mathematical theory of elastic impact,[2] "when two such bodies come into collision, sometimes with greater and sometimes with less mutual velocity, but with other circumstances similar, the velocities of all particles of either body at corresponding times of the impacts will always be in the same proportion;" from which it is clear, that in a mixture of two kinds of gas, as hydrogen and oxygen for example, when the mean velocity of the molecules is so increased that the vibration of the ultimate atoms of the hydrogen is increased a certain per cent, then that of the ultimate atoms of the oxygen is increased by the same per cent. But the circumstances of the encounters and the forces acting between the ulitmate molecules determine what fraction the mean kinetic energy of vibration of the ultimate atoms shall be of that of the molecules whose encounters cause these vibrations. Since the circumstances attending the encounters are dependent simply upon the forces acting between the ultimate atoms assumed to be in all respects equal, the energy of their vibration will be the same in an atom of hydrogen as it is in an atom of oxygen; for each degree of freedom of every ultimate atom of either element is similarly circumstanced, both as regards forces between itself and other ultimate atoms of the same chemical atom, and also as regards the impacts of other molecules. The proposition of the kinetic theory which makes the energy of each degree of freedom the same, which has been erroneously applied to the degrees of freedom of molecules, can therefore be correctly applied to the ultimate atoms.

But it might not, at first glance, be apparent whether these vibrations are caused by, and are proportional to, the mean progressive energy of the molecules, or to their rotary energy combined with it. But it is not difficult to show that the vibrations of the chemical atoms with respect to each other are proportional to the mean progressive energy alone, and then to show the same for the ultimate atoms. Although, in the paper upon the vibratory motions of atoms within the molecule, we have for mathematical purposes considered the centrifugal force as causing vibrations of atoms with respect to each other, yet in fact the vibrations so caused are vanishing quantities, compared with those caused by the component of the impulsive force acting during an encounter along the line joining the atoms of a molecule. The magnitude of such a vibration, other things being equal, depends upon the suddenness of the impulse; and the suddenness of the force called into play during a change of rotary velocity, by deviation from motion in a tangent to motion in a circle, can bear no comparison to the suddenness of a direct impulse along the radius of the circle. Hence the direct impulse due to the progressive motion need alone be considered.

It thus appears that the energy of vibration of chemical atoms with respect to each other in a simple gas is proportional to its mean progressive energy. The same is true of the vibrations, with respect to each other, of the ultimate atoms which form a chemical atom, and for the same reasons; for the forces which act upon the ultimate atoms are the impulses due to the encounters of other molecules, and those due to the remaining chemical atoms of the same molecule. The energy of the latter of these motions is proportional to the former, as has just been shown; hence their sum is so also: therefore the energy exerted to deform a chemical molecule, and set it in vibration, is proportional to the mean progressive energy.

[1] Constants of nature, part v. A recalculation of the atomic weights. Washington, 1882.
[2] Thomson and Tait's Natural philosophy, 1867, art. 302.

But it is to be noticed that the impulses due to the vibrations of the chemical atoms within a molecule are vastly more frequent than the molecular impulses; and it appears probable that the vibrations of the chemical atoms set up during an encounter will rapidly decay, even in case they do not themselves directly originate radiations. The vibratory energy of this kind may then be changed almost instantly into that of vibration of the ultimate atoms.

According to the hypothesis which we are now considering, the temperature of the body and the intensity of the radiation depend solely on the vibratory energy of the ultimate atoms; but, since these ultimate atoms are assumed to be in all respects equal, they vibrate under the action of the same forces, and have the same degrees of freedom and constraint within the chemical atoms of one element as they do within those of a different element. Hence it appears, that if the ultimate atoms of two different gases have the same vibratory energy (i.e., cause vibrations of the same intensity), so that the flow of radiant energy is the same from all the ultimate atoms of each gas, then there will be no disturbance of this equilibrium when these gases are mixed; in which case the distribution of energy is effected by molecular encounters, which distribute equal mean amounts of energy to each molecule, instead of by radiations, which distribute equal mean amounts of energy to each ultimate atom.

In attempting to account for the high specific heat of liquids, I have elsewhere given reasons for supposing that it is due to a certain per cent of dissociation, which increases with the temperature. It appears probable, that, although some small amount of dissociation may exist in gases also, there is not so large a per cent as in the liquid state, nor does the per cent necessarily increase with the temperature; for by reason of the free progressive motion in a gas, which does not exist in a liquid, any dissociated atoms have a much better opportunity to recombine; and, as the velocities (especially those of free atoms) increase with the temperature, these opportunities increase, as well as the number of dissociations occurring in a unit of time; so that, at a high temperature, an atom of gas may not stay dissociated so long as at a lower temperature, while in a liquid this interval will not be sensibly affected by the temperature.

It is thought that the law of Dulong and Petit receives reasonable explanation on the hypothesis that the ultimate atoms have each the same kinetic energy at the same temperature, as will be shown in a subsequent paper; but perhaps the strongest direct evidence in favor of the proposed hypothesis is found in the fact that even the simplest elements, such as hydrogen or mercury, have spectra of several lines at least, showing that the source of the light must be sufficiently complex to be able to vibrate in a number of different ways, such as may well be possible for an atom formed of a number of ultimate atoms, but such as is inconceivable in a molecule consisting of one or two perfectly hard atoms. H. T. EDDY.

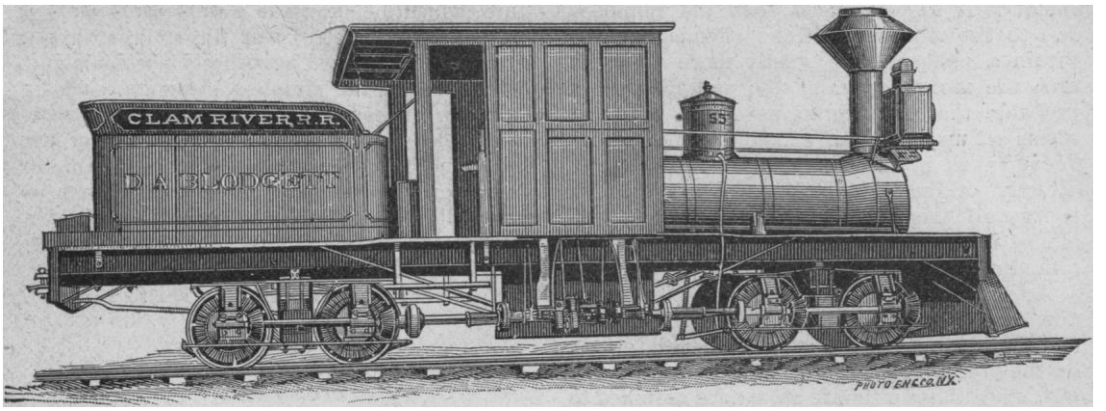
THE NATIONAL RAILWAY EXPOSITION.[1] — IV.

THE exhibit of locomotives was remarkably complete, and comprised engines differing widely in size and power, and adapted for every variety of work; but a certain uniformity of the design of the main features would seem to indicate that locomotive practice has settled down into a certain groove, and that the methods of construction now adopted are so satisfactory that few exhibiters propose to greatly improve upon them by any radical alterations, though one or two of these new departures, such as the Wootten firebox and the Stevens valve-gear, seem likely to come into extensive use.

The main tendency of locomotive design seems to run rather in the direction of larger bearing surfaces and stronger working parts than in any novel methods of construction; while sound and accurate workmanship, and plenty of good material judiciously distributed, are relied on to make a locomotive durable, hard-working, and trustworthy under trying conditions.

Mr. E. Shay of Haring, Mich., exhibits a model of an engine of peculiar construction for 'logging' purposes. These small railways are exceedingly light in construction, and the rails and ties are generally laid directly on the surface of the ground, without any great attention being paid to preliminary grading or alignment; and therefore a suitable locomotive must unite considerable tractive power with great flexibility of wheel-base, and a small weight, on any one pair of wheels. Mr. Shay accomplishes this by using a Forney type of locomotive, having a pair of drivers under the barrel of the boiler, and a four-wheel truck, carrying the tank and fuel, behind the firebox. All the wheels being made of the same diameter, a pair of vertical engines are secured to one side of the firebox, working a longitudinal shaft which

[1] Continued from No. 25.



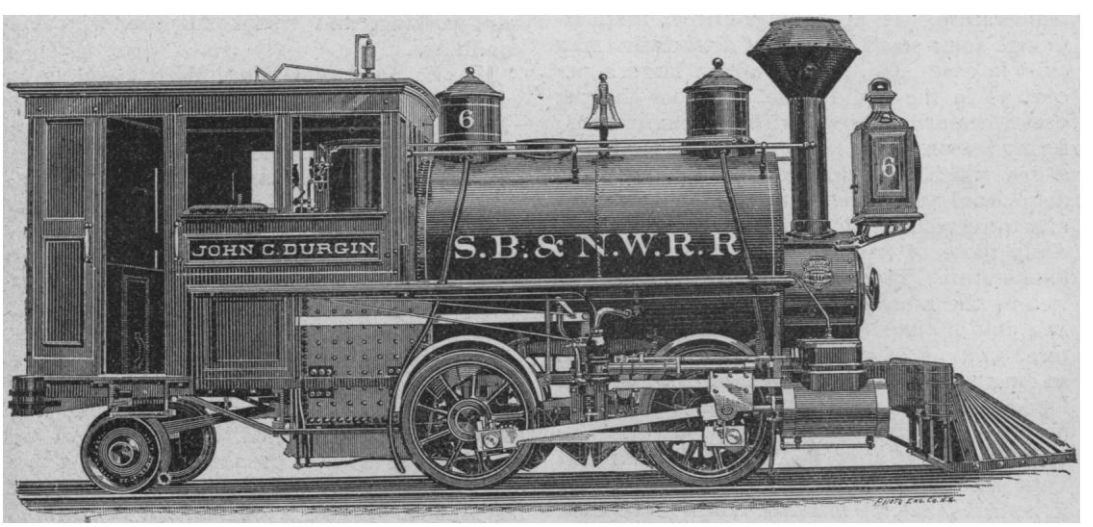
LOGGING LOCOMOTIVE WITH GEARED DRIVING-WHEELS.

runs beside the wheels. Bevel pinions on this shaft engage bevel wheels on the hubs of the wheels, and, as the shaft is provided with universal and telescopic joints, the whole of the wheels can be driven simultaneously, no matter how sharp the curve over which the engine may be running; and, owing to the interposition of gearing, comparatively small-sized cylinders are sufficient to enable the engine to haul very heavy loads, and yet run sufficiently fast for the nature of the work.

Mr. Shay informs us that nearly a hundred of these engines are at work, some on wooden rails, and that they are giving great satisfaction. The mode of driving appears to be novel, and, despite some complexity, is free from many of the disadvantages of the Fairlie system, which also utilizes the adhesion of radiating axles.

Messrs. H. K. Porter & Co. of Pittsburgh, Penn., also exhibit an engine specially adapted for logging railways. Ordinary methods of construction are, however, followed; and the consequent greater simplicity is of great advantage where the work for a few months in the year is very severe, and no repair-shops are situated within convenient distance. The engine exhibited is of the following dimensions, and is calculated to work safely on a rail weighing only thirty pounds per yard: —

Cylinders, diameter and stroke	10 in. × 16 in.
Driving-wheels, diameter	36 in.
Truck-wheels, diameter	22 in.
Rigid wheel, base	5 ft. 3 in.



LOGGING LOCOMOTIVE EXHIBITED BY H. K. PORTER & CO.

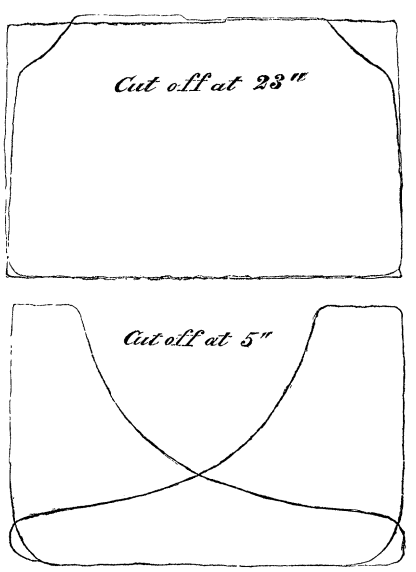
Total wheel base	13 ft. 4 in.
Weight in working order	31,000 lbs.
Weight on drivers.	26,000 lbs.
Water-capacity of tank	500 gallons.

Messrs. Porter state that a similar engine, working day and night on a road 11 miles in length, with grades of 53 feet per mile, has handled 350,000 feet of logs in 24 hours, running about 180 miles in that time.

The engine exhibited is well designed, and the workmanship is fully equal to that on a first-class main-line engine.

The Cooke locomotive works of Paterson, N.J., exhibit an engine for the Southern Pacific railroad which is believed to be the largest locomotive in the world, the cylinders being 20 inches diameter by no less than 30 inches stroke. The designer of this engine, Mr. N. I. Stevens, general master mechanic of the Central Pacific railroad, is, however, building a still larger engine at the company's shops at Sacramento, Cal., the cylinders of which measure 21 inches by 36 inches. This latest development will exert a tractive force of 278 pounds for every pound per square inch average pressure on the pistons; that is to say, with an average pressure on the pistons of 100 pounds per square inch throughout the stroke, this engine would exert a tractive force or pull of 27,800 pounds, less the internal friction of the working-parts of the engine. Whether the average drawbar of the average freight-car is capable of safely standing such a strain is a question which experience will probably solve in a direction unfavorable to weak draw-gear. Apart from their immense size, these engines are interesting as being fitted with a novel form of valve-motion. The engine exhibited has four slide-valves to each cylinder, two main valves, and two riding cut-off valves. An excellent diagram is obtained, the cut-off being sharp, and the compression very slight; and the gear seems well adapted to a slow-running freight-engine. In the later and larger engine, but two valves are employed, and but one eccentric; motion being taken from the engine crossbead. The results of this simpler gear promise to be equally good, and the trial-trip of this engine will be looked forward to with great interest.

The Grant locomotive works are the makers of the only engine which departs from the sober suit of black in which its competitors are arrayed; and further examination shows that its peculiarities are not confined to the outside appearance, but extend to the fuel to be used, which is entirely novel in character. The inventor, Dr. Holland, proposes to raise steam by means of the combustion of decomposed water. The heat evolved by burning naphtha is used to separate the oxygen and hydrogen in superheated steam; and, the carbon of the naphtha kindly uniting with the oxygen thus set free, the hydrogen is burnt by means of oxygen obtained from atmospheric air. The inventor states that the only products of this combustion are carbonic acid and water, the nitrogen disappearing in some mysterious manner not yet fully understood. The old fallacy that water can be decomposed and then reunited, with a positive advantage as regards heat, is here again illustrated; while the strong smell of burning naphtha during the trial of the engine in the exposition indicated that this convenient auxiliary was used to a considerable and probably wasteful extent.



INDICATOR DIAGRAMS OBTAINED ON LOCOMOTIVE BUILT AT THE COOKE LOCOMOTIVE WORKS.

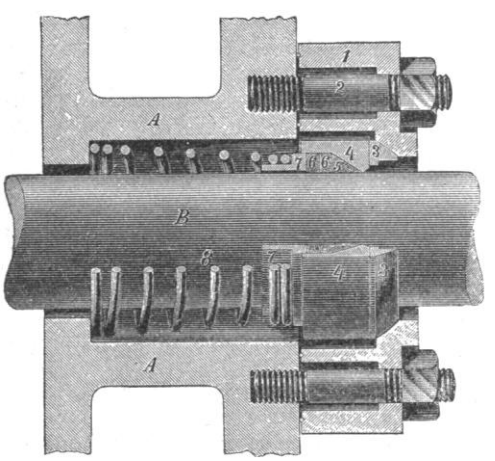
The Philadelphia and Reading railroad exhibit a fast passenger-engine fitted with Woottens' patent firebox, which is adapted to burn any waste or inferior quality of fuel. Reversing the usual practice on locomotives, the combustion on this engine is slow, owing to the enormous area of the grate (72 square feet), instead of a small one (16 or 17 square feet), while the blast is not severe, and the fire is one-third the usual thickness (4 inches instead of 10 or 12 inches); the result being a less vivid combustion, the interior of the fire-box being dull red in place of the white heat usual when

a locomotive is at work. Trials at Chicago seemed to indicate that the engine was capable of maintaining steam with almost any kind of fuel, and that the lignite and inferior coal of the new north-west, which often contains only thirty-five per cent of carbon, can therefore be utilized under locomotives.

The slow combustion does not produce a heat intense enough to fuse the slag, and therefore the firebars keep clean and free from clinker; and it need hardly be pointed out that this is an important practical consideration in dealing with fuel which contains over fifty per cent of ash.

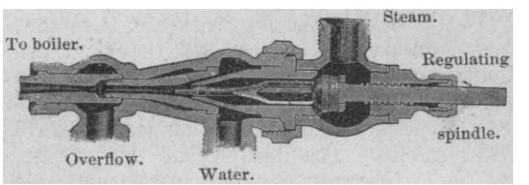
The large grate area is obtained by placing the fire and grate bars completely over the driving-wheels, where plenty of width is obtainable; and the firebox is accordingly made no less then 8 feet wide inside, instead of the usual 33 inches. It might be anticipated that the increased height of the centre of gravity would tend to make the engine unsteady at a high speed; but a precisely opposite result is obtained, as the engine rides with remarkable steadiness and smoothness, even at the highest speeds.

The Shaw engine has been so often described, and been so prominently before the public, that it is only necessary to say here, that, though exhibited at the Chicago exposition, want of time prevented any proper scientific tests being made to ascertain the real value of the invention.



Metallic packing for piston-rods.

Various forms of metallic packing for piston-rods are now being extensively used with excellent results, the wear of both rod and packing being very slight, while the use of anti-friction metal obviates the frequent renewals necessary with hemp, rubber, and other packings which are destroyed by heat rather than by wear. In the packing which we illustrate, provision is made for any inaccuracy in fitting by allowing the piston-rod some play in the stuffing-box; the vibrating cup, 4, sliding on the ball and socket ring, 3. As the packing rings are pressed to their work by a spring, it is impossible for a careless engineer to screw his packing too tight, or to make it bear on one side only of the rod.



Mack's improved lifting injector.

The National tube-works of Boston, Mass., exhibited an injector at work, which possessed some points of novelty, and appeared to be well adapted for use on locomotives working with bad water. The very fact that a simple arrangement of hollow cones can enable steam to lift and force water into a boiler working at the same pressure is in itself a remarkable paradox; but Mack's injector, as shown at work in the exposition, forced a small quantity of water into a boiler working at two hundred pounds per square inch when the injector itself was only supplied with steam of half that pressure. The apparatus was so arranged that the quantity of water forced against different boiler-pressures by the same pressure of steam could be readily gauged; and the results were interesting as showing what a large range of work can be performed by an apparatus which has no moving parts. The injector is made in several pieces, so that it can be readily taken apart, and cleaned of scale deposited by hard or lime water. When the injector is started, the water is lifted by means of a jet of steam, which rushes through a very fine hole running longitudinally through the centre spindle; the injector becomes full of water, which escapes at the overflow; the regulating spindle is then screwed back, and the large volume of steam thus admitted is condensed by the water already in the injector, mingles with it, and the momentum of the steam due to its great velocity (some five thousand feet per minute) drives the combined steam and water into the boiler.

THE INTERNATIONAL FISHERIES EXHIBITION. — THIRD PAPER.

IN eight weeks over seven hundred thousand persons have visited the exhibition; and there are no signs of any decrease in the daily attendance, which averages from twelve thousand to eighteen thousand, except on Wednesdays, when, the price of admission being half a crown instead of one shilling, the number is only about half as great. Wherever one travels by public conveyance, some of his neighbors in the car or the omnibus are always laden with the ponderous blue catalogue of the exhibition. London is thoroughly permeated by the interest in fish and fisheries. On Sunday I felt a desire for a change of topic, and sought refuge under the dome of St. Paul's; but the canon of Worcester, who officiated at the service, preached a sermon on the miraculous draught of fishes.

Since the middle of July the galleries have been lighted by electricity until ten o'clock. The result has been very satisfactory, the illumination in many cases being more effective than that by sunlight. The annoyance of heavy shadows is avoided by the use of a large number of lamps. All the principal systems being represented, there is an excellent opportunity for comparison. The following is the official distribution of the electric lighting of the exhibition: —

1. Siemens Brothers and company (limited)	Conservatory	4 arc-lights, 6,000-candle power.
	Main gallery, Great Britain	1,200 incandescent lamps (Swan).
2. Swan united company (limited)	Royal pavilion	280 incandescent lamps (Swan).
3. Gülcher electric-light company (limited)	China, New South Wales, etc.	600 incandescent lamps (Crookes).
	Canada and United States, Norway and Sweden	30 arc-lights, 1,000-candle power.
4. Electric-light supply company (limited)	Fish-market	7 arc-lights (Volta), 50 incandescent lamps.
5. Ferranti, Thompson, and Ince	Aquarium and west corridor	1,000 incandescent lights.
	Machinery in motion, Electric-light machine-shed, Greece, Italy, Great Britain	25 arc-lights (Ferranti), 5,000-candle power each.
6. H. Edmunds	Promenade	50 arc-lights.
	Upper terrace	6 large arc-lights on mast.
	Eastern corridor and fine arts vestibule,	500 incandescent lamps.
7. Charles Lever	Council-room, Lecture-hall, Dining-rooms, Kitchens	28 arc-lamps (Lever).
8. Jablochkoff electric-light company (limited)	Netherlands, Belgium, Part of the United States, etc., Part of Sweden, etc	60 lamps (Jablochkoff).
9. Mackie	Life-saving apparatus shed	15 arc-lamps (Lea).
	Board of trade shed	6 arc-lamps (Werrdemann).
10. Brockie	North corridors, for exhibition of stuffed fish	20 arc-lamps (Brockie).
11. Gérard	Spain and Russia	36 arc-lamps (Gérard).
12. Sun-lamp electric-light company	Entrance vestibule	24 lamps (Soleil).
13. Goulard and Gibbs	Sixteen stations in different parts of the building	Arc and incandescent lamps of various characters.

My observations at the exhibition have been confirmed by what I saw at the Royal college of surgeons at the conversazione recently given by the president and Lady Wells. The museum was perfectly lighted by about six arc-lamps in each of its spacious halls. The arc-lights, too, are used in the art museum at South Kensington with very excellent effect; six of them accomplishing what is done, no more effectively

I have been particularly interested in studying the adaptability of the various lights to museum purposes, and am thoroughly satisfied that a few large arc-lamps are preferable to a great number of small ones. The light seems softer, more powerful, and more evenly diffused, in a room like the main gallery assigned to the United States, where there are six lamps in a room fifty by a hundred and forty feet, at a distance of perhaps fifteen feet from the floor, than by a system like that in the British sea-fishery gallery, where the twelve hundred Swan incandescent lamps are used 'to demonstrate the possibility of lighting large areas by incandescence,' as the official catalogue states. Thirty lights of the Gülcher or Edmunds patterns would give a much better effect in this great shed, eight hundred and forty by fifty feet in dimension. The effect of a large number of incandescent lamps disposed along the roof of a room in every direction is very bewildering: they detract the attention, and give one the feeling that a long stay will be sure to result in a headache. In the Chinese court the Crookes incandescent lamps are used, each suspended under a shade of brightly-colored glass: the general effect is rather pretty, but the collections are scarcely discernible.

though perhaps more agreeably, in a hall of the same size by about two hundred gas-jets. The expense of lighting some twenty halls by gas in this generous manner must be far greater than by electricity.

On the 18th of June the International fishery conference began its sessions in the conservatory of the Royal horticultural society, adjoining the exhibition galleries. Meetings have since been held every day except Wednesdays and Saturdays. The inaugural address was delivered by Professor Huxley, and was an admirable introduction to the papers which were to follow. First referring to the antiquity of fisheries and their influence upon the history of man, he spoke at some length of the fisheries of the Phoenicians, the Romans, and the early Britons. Insisting upon the importance of fish as food, he next took up the question, 'Are the fisheries exhaustible?' and, after tacitly admitting that certain fisheries may be destroyed, went on to describe the enormous abundance of cod, mackerel, herrings, and sardines, and to express his firm belief that their numbers cannot be effected by human agency. He concluded with a very strong condemnation of unnecessary legislation.

Upon this occasion the Prince of Wales presided, and there was an impressive assemblage of diplomats and state officials. On the following day the prince again was present, and read a paper an hour and a half in length, written by his brother the Duke of Edinburgh, who is absent in Russia attending the coronation of the czar. This paper, entitled 'Notes on the sea-fisheries and fishing population of the United Kingdom,' is in many respects the most remarkable which has been presented to the conference. It is by far the most exhaustive and scholarly essay on the fisheries of Great Britain which has ever been published, and contains a great store of valuable facts gathered by the Duke of Edinburgh during the three years in which he served as admiral in command of the naval reserve, together with extensive statistics obtained at his instance by the men of the coast-guard. On the 21st Sir James Gibson Maitland, the proprietor of the most extensive fish-cultural establishment in Europe, located at Howieton, near Stirling, read a paper on the 'Culture of Salmonidae and the acclimatization of fish,' and the following day Professor Leone Levi of University college, London, on the 'Economic condition of fishermen,' — an important contribution to social economy. On Monday, the 25th, the American commissioner read a paper on the 'Fisheries of the United States and the work of the U. S. fish-commission.' Mr. James Russell Lowell occupied the chair, and made one of his wise and witty little speeches which are so thoroughly enjoyed by the English people.

On the 28th Mr. R. W. Duff, M.P., spoke on the 'Herring fisheries;' on the 29th Prof. A. A. W. Hubrecht of Utrecht university, on 'Oyster-culture and the oyster-fisheries in Holland,' and Mr. R. B. Marston, on 'Coarse fish-culture,' — 'coarse fish' in England signifying fresh-water fish other than the Salmonidae. On July 1 Mr. L. Z. Joncas read a paper on the 'Fisheries of the Dominion (of Canada);' and, on the 3d, Professor Huxley spoke most instructively upon the 'Diseases of fishes,' confining his remarks to the history of the salmon-infesting Saprolegnia ferax. On the 5th several of the commissioners from continental European nations spoke of the fisheries of their respective countries, and on the 6th Capt. Temple gave an account of the antarctic seal-fisheries.

The discussions have been in some instances important, though the usual disposition to ramble has been difficult to check. In fact, the ponderous British system of closing each session with four formal speeches, in connection with the votes of thanks to the chairman and the speaker, has rather tended to encourage the utterances of generalities. The 'practical men,' as they style themselves, who take the very unnecessary precaution of informing their hearers that they make no claim to being 'scientific,' have been rampant at these meetings. Professor Huxley's inaugural address has caused great unhappiness to those who believe in legislative protection without limit or reason. Close seasons for river-fisheries are needful and useful; but what is to be done with economists who claim that legislation will relieve the salmon from its pestilential parasite, the Saprolegnia ferax?

The juries began their sessions about the middle of the month; and the galleries are still daily invaded by enterprising little groups of men with note-books. Their task is not a light one; for the number of exhibiters must be at least three thousand, and the heat is greater than London has known since 1860. Science is well represented among the jurymen: Professor Flower, Professor Allman, Mr. John W. Clark of the Cambridge museum, Mr. Henry Woodward of the British museum, Professor Moseley of Oxford, Mr. John Murray of the Challenger, Lord Russell, Dr. Murie (secretary of the Linnaean society), Dr. Francis Day, Professor Huxley, Mr. R. H.

Scott, Professor Ray Lankester of University college (London) and Professor Jeffrey Bell of Kings college, Dr. Spencer Cobbold, Mr. Romyn Hitchcock of New York, Mr. R. E. Earll of Washington, Dr. Hubrecht of Utrecht, Professor Smitt, Professor Torell and Dr. Trybom of Sweden, Dr. W. A. Buch of Norway, Professor Giglioli of Florence, Dr. Steindachner of Vienna, and Mr. E. P. Ramsay of the Sydney museum (New South Wales), — are all here in the work. Just before the opening of the exhibition, *Nature*, in an editorial, after stating that the management of affairs had been trusted almost entirely to 'practical' men, to the exclusion of English men of science, expressed some doubt as to whether this policy would effect as satisfactory results as that of the Berlin exhibition. It would be interesting to know how far this hint has influenced the action of the executive committee. The committee has shown itself singularly sensitive to the voices of well-meaning advisers, and changes are constantly being made for the better in the management of affairs. For instance: the conference chamber has been removed from the conservatory, where it was torture either to speak or to listen, to one of the picture-galleries near the main entrance; and the experimental fish-market in connection with the exhibition has been thrown open to the public without admission-fees, and a separate entrance cut through from Exhibition road.

The papers read at the conferences are being printed in full, together with the discussions which follow them, and will form a valuable little library, when supplemented by the shilling handbooks to the exhibition, which are being rapidly printed. Fifteen of these handbooks are announced, in addition to the eighteen or more 'papers of the conferences.' The literature of the exhibition is reserved for future discussion. It is much to be hoped that the authorities will crown the series with an illustrated report, prepared by scientific committees, similar to the valuable 'Amtliche berichte über die Internationale fischereiausstellung zu Berlin.'

The closing address at the conference by Professor Ray Lankester will be upon 'The scientific results of the exhibition.' It would not be surprising if Professor Lankester were to choose to act the part of the prophet rather than that of the recorder, and to point out in his discourse what the exhibition ought to do for science. A number of prominent educators and investigators have already addressed to the executive committee a memorial advocating the establishment of a national marine zoölogical station with a part of the surplus funds, which, from present appearances, are likely to remain over at the end of the exhibition. In another letter I hope to review briefly the most important features of the exhibits of the several countries. G. BROWN GOODE.

Richmond Hill, July 10.

THE PARIS OBSERVATORY.

WE abstract from *Nature* the items of chief interest in the report of Admiral Mouchez, the director of the Paris observatory, on the state of that institution during the past year. Its service has been considerably deranged by the preparations for the transit of Venus. The various members of the expedition attended the observatory to be trained either in photography or in the use of the artificial transit, and no less than five of the *personnel* of the observatory themselves took part in the work. The grounds of the observatory have been extended, the equatorial *coudé* has been installed, and several underground chambers have been constructed for the purpose of studying magnetism and terrestrial physics generally. A revision of Lalande's catalogue of stars, numbering forty thousand, has been going on for the past four years. The general catalogue, which will form eight volumes in quarto, is well in hand; and four volumes will be published during the next three years. Meridian observations, numbering a hundred and ten thousand, have already been made, to assist in the construction of the catalogue.

The common inconveniences attending the use of equatorials of the usual form of construction have led M. Loewy to conceive the idea of adapting to the equatorial the system of '*lunette brisée*,' employed first in England, and afterward to a greater extent in Germany, especially in small transit instruments. The new *coudé* equatorial may be thus described: the polar axis of the instrument is supported at its extremities on two pillars, like a meridian instrument; round this axis the telescope turns, forming a right angle at the lower support; by means of a mirror placed at the summit of this angle, the light is reflected along the pierced axis, at the end of which the eye-piece, or micrometer, is placed. Under these conditions, with the telescope at rest, objects on the celestial equator pass across the observer's field of view. In order to secure the observation of objects not on the equator, a mirror free to rotate is placed before the object-glass, and connected with the declination-circle. The inclination of this mirror may be changed so as to throw into the tube the light coming from a star of any declination. The observer may thus explore every part of the heavens without quitting his position at one end of the polar axis. The telescope may practically, by a rotation of this axis, be directed toward any part of the celestial equator, whilst a star of any declination may be made to throw its light down the broken telescope by means of the external mirror. Preliminary ex-

periments have shown that this double reflection does not occasion a great loss of light; and the figure and polish of the silver on glass mirrors are very satisfactory. The observatory possesses this new instrument through the liberality of the well-known patron of French astronomy, M. Bischoffsheim.

In regard to physical observations, M. Egoroff, professor of physics at Warsaw, was occupied at Paris during the months of July and August, as in preceding years, with the spectroscopic study of atmospheric absorption, working with a beam of electric light sent from Mont Valérien to the observatory. In consequence of the decision of Admiral Mouchez to separate special meteorological investigations from the astronomical work of the observatory, meteorological observations of a much higher value are now being made, with the special object of determining the different corrections, of the nature of refraction, to be applied to the astronomical observations. A series of observations is to be made from a captive balloon of such size, that, with ordinary gas, it can, in calm weather, take self-registering barometers, thermometers, and hygrometers up to a height of five hundred, and with pure hydrogen to a height of eight hundred metres. The balloon cannot be well managed if the velocity of the wind exceeds four or five metres per second; but this is not regarded as inconvenient, because it is during complete calm that the greatest abnormal perturbations of astronomical refraction manifest themselves. Simultaneous observations will be made on the meridian of the Paris observatory, north at the observatory of Montmartre, and south at the observatory of Montsouris.

The construction of the great refractor of 16 m. focus, together with its dome 20 m. in diameter, is steadily progressing. The object-glass figured by M. Martin is already complete. The dome is to be of the same dimensions as the Pantheon, and the largest ever attempted. The arrangement for insuring its turning with ease, and which has been adopted for its construction, is that proposed by M. Eiffel. In order to reduce to a minimum the friction of circular rollers, he proposes to float the dome by means of an annular *caisson* plunged in a receptacle of the same form, and filled with a liquid which will not freeze, such as an aqueous solution of chloride of magnesium. At the Paris observatory it is quite necessary that some such arrangement as this should be adopted; for the observatory is situate over the catacombs, one result of which has been, that for many years the pillars of the meridian-circle erected in the gardens have gradually inclined toward the east in consequence of the displacement of the soil. With mechanism of this form for rotating the dome, any probable change of level would not prevent the dome from turning.

The magnetic observatory now being completed will be one of the first order. Six subterranean chambers of constant temperature have been built under the best possible conditions of isolation and stability. An outer wall of nearly 2 m. thickness encloses a rectangular space 40 m. in length and 14 m. wide, completely impervious to moisture. The vaulted roof, 1 m. thick, is covered by earth to the thickness of 2 m., and grass and planks protect the soil from the direct rays of the sun and from frost. The observing chambers can be lighted either by gas, or by reflection from without.

Advantage has been taken of the existence of these chambers by placing in them the clocks from which the time is distributed throughout Paris; but, in spite of all precautions, the chambers are found to be not altogether free from minor trepidations resulting from the traffic of the streets. Apparatus has been constructed, and is now ready for use in investigating the vertical and slow movements of the soil. This will be placed in a gallery in the catacombs 27 m. below the surface.

The erection of an astronomical observatory on the Pic du Midi, at a height of 2,859 m., is engaging the attention of the director. At this elevation, it is said to be easy to read at night by starlight alone, and fifteen stars are visible to the naked eye in the cluster of the Pleiades. It is intended that any astronomer who wishes to make any special researches may take advantage of the observatory on the Pic du Midi.

LETTERS TO THE EDITOR.

The right whale of the North Atlantic.

I have noticed in a late number of your journal a criticism on the last Bulletin of the American museum of natural history. Being away from town, I have not access to works referring to the subject of cetology; but with the aid of notes that I have with me, as well as drawings of the subjects involved, I hope to show conclusively that other views than those taken by the critic are the correct ones.

I shall not attempt to justify the carelessness that permits the presence of typographical errors; but, when an *errata* list accompanies a work, it should have due credit for its intentions.

The writer says, "There are errors of statement of so grave a character as to require notice," and continues, "It would seem, for instance, that only the merest novice in cetology could have been misled," etc. — referring to the identity of the St. Lawrence whales.

Lesson wrote, "What an impenetrable veil covers our knowledge of the Cetacea! Groping in the dark, we advance in a field strewn with thorns." I believe that some in later days, not quite novices, admit a degree of unfamiliarity with the great beasts of the sea. In that view, let us see if 'errors of statement of grave character' have really been made.

The president of the Quebec historical society, Dr. Anderson, with Dr. DeKay's Report on mammalia before him, says, speaking of a large whale that had foundered in the St. Lawrence River, "It turned out to be an aged male, apparently the species Balaena mysticetus. . . . The back was black; the belly, furrowed, presenting the appearance of a clinker-built boat. . . . I concluded, after a careful examination, it answered fully the description given by Dr. DeKay for the mysticetus. . . . As the whale lay upon the beach, he was sixty-five feet long; the fluke of his tail was twelve feet; his jaw, fifteen feet."

This whale was noticed primarily by us for the purpose of directing attention to the fact, that such a great form had really pushed into the fresh-water

stream as far as Quebec, and to show that possibly Professor Flower had misapprehended when he was told of stranded whales in the St. Lawrence; he, in absence of description, naturally regarding them as white Belugas.

Besides this, several alternatives were presented in the absence of the mention of *most distinctive* characters; but no definite statement was hazarded, nor was one intended.

The first paragraph touching on this notice of the St. Lawrence whale, and which is included by the critic as among the 'grave errors of statement,' is as follows: "It is pretty certain that if the creature was really a Balaena, and not a Balaenopter, it was an example of unusual size." As we had no intention of arguing any case, this cannot be regarded as more than courtesy to Dr. Anderson, who had stated his unqualified opinion as above.

The next passage in our text is, "The furrows on the belly naturally suggest the Balaenopters; but it is inferred that there was no dorsal fin." The dorsal adipose fin being an essential feature in the latter, absence of any notice of it naturally seemed strange.

As there was no description of the head, save as related to its length, the baleen not being measured, the only character that suggested strongly the finback was the clinker-built aspect of the belly. In this view the statement of Scoresby might well lead to misapprehension, even by some not wholly novices.

Scoresby says (in his description of the B. mysticetus), "The skin of the body is slightly furrowed, like the water-lines in coarse-laid paper."

The fluke of the tail is described as twelve feet in length. Here, regarding the possible fact of there being *two* flukes to the tail, the total width of the caudal extremity would be twenty-four feet, the actual measurement of a large example of a right whale. That the writer in the bulletin did so regard it is true; but, in the light of after-knowledge, we have no doubt that Dr. Anderson meant to include the whole width as twelve feet.

In the absence of definite features in Dr. Anderson's description, and in view of the absence of any attempt in the bulletin to argue in favor of any one genus or species, we regard it as a subject that hardly calls for criticism. In short, taking the evidence recorded, to our mind it seems to be quite as easy to prove the creature of one genus as the other; and by that we mean that Dr. Anderson's positive statements should not go for nothing. We are not, however, ready to hazard an opinion that the whale was not a fin-back, as we certainly did not in the bulletin.

The next point refers to Scoresby and his drawings. That Scoresby did not portray his subject correctly, so far as relates to the Greenland whale, is, we feel sure, susceptible of demonstration, even if we should omit the opinions of three of the most able cetologists. The critic claims, "That it was the best figure [Scoresby's], if not quite correct in all points, of the species down to 1874, when Scammon's admirable illustration was published, has, I think, hitherto been unquestioned." When we are told that our opinion that Scoresby 'furnished to science an incorrect figure' is 'an error of statement of so grave a character as to require notice,' we answer by quoting from Professors Eschricht and Reinhardt, in their article on Greenland whale, in Ray society's publ., p. 29. It is well known that these distinguished authors are leading cetologists, whose work is edited in English by Professor Flower. The latter, therefore, is supposed to acquiesce in their opinions. These authors say, "We must confess, that as to proportions we confide more in these drawings [referring to Marten's and Zorgdrager's] than Scoresby's, which certainly represents the Greenland whale (B. mysticetus) more slender than it really is."

Besides this, we claim to be able to demonstrate the correctness of our statement by reference to the figures. We have before us those of Scammon, Scoresby, Zorgdrager, and Lacépède, representing the Greenland whale. We also have the Bachstrom figure of nordcaper, published in Lacépède's work. With Capt. Scammon's figure before us, the one admitted by our critic to be an 'admirable illustration,' compare now Zorgdrager's; and we find, that, though rude in finish, it is nearly an exact counterpart of the Scammon figure. We see that the form is bulky, and has a very short 'small,' or caudal region; that its head is of the proportion of one-third the total length of body; its pectoral limbs are situated very closely behind the eye and angle of the mouth, not a quarter of the total length of the 'flipper' distant therefrom, — all of which features are recognized as correct.

Let Scoresby's figure be compared with Zorgdrager's, which we have seen is essentially the same as Scammon's. We see that the form is not only not bulky, with a very short 'small,' or caudal region, but has the body very slender, with an elongated 'small;' the latter being so slender that it is represented whipping the air like the tail of a saurian. Its head is one-fourth of the total length of body, instead of one-third, as in nature, and in the Zorgdrager and Scammon figures. Its pectoral limbs are situated at a distance from the eye and angle of mouth represented by the *total* length of the limbs. It is therefore seen, that, in accordance with all evidence, Scoresby's figure was not correct. Hence it *is* "deplorable that nearly every book published to this day has an illustration copied from Scoresby."

"'Tis true 'tis pity, and pity 'tis 'tis true."

Our critic next attributes unfamiliarity with Scoresby's cetological writings, from the fact that we credit Godman with 'an amount of anatomical knowledge quite unusual.'

The truth is, the edition of Scoresby in our possession does not contain the portion relating to interior anatomy and physiology, and the plates representing the spiracles. It is 'An account of the arctic regions, Edinburgh, 1820.' The work is not before us, but a reference to this edition will verify our statement. Since the matter was prepared for the bulletin, we find that the several pages relating to this portion of Scoresby's description were probably never printed therein. We have, however, found the whole in Sir William Jardine's Naturalists' library, volume on whales, by Col. Hamilton.

In view of this fact, one may venture to claim a degree of immunity from severe criticism, though evidently he may be open to the accusation that 'he is none too familiar with Scoresby's cetological writings,' or at least his various editions.

Not having met with this matter relating to the anatomy and physiology in Scoresby's book, it was but natural to attribute to Godman 'an amount . . . quite unusual.'

A point succeeds this, concerning which we must take issue with the critic. He says, "The fact being that Godman's account is an unaccredited compilation from Scoresby's work, whole pages being taken entire," etc. We find in our edition of Godman's Natural history, instead of 'an unaccredited compilation,' the following: "Having never personally enjoyed opportunities of studying the whale in his native floods, and having derived all we know in relation thereto from Scoresby, we should deem it

injustice to the reader to give this account in any other language than that of the original. We do this without reluctance, as our object is to convey the most accurate knowledge, rather than produce a work exclusively of our own composition. All that follows in relation to the whale is selected from the different works of the accurate and philosophical Scoresby." If the critic's edition of Godman has played false with him, as our edition of Scoresby has with us, perhaps he may think it wise to 'cry quits,' and join with us in throwing out of the case the two slippery points.

It may be proper to add here, that we are familiar with Scoresby's second figure of mysticetus, which is so far improved as to have the 'small' shortened; but unfortunately the first figure, with all its imperfections, is the one that has been brought down to us through every book on natural history.

The reference to Bachstrom's figure of nordcaper is obscure.

It matters not what that figure *is:* it was regarded as one of nordcaper by Cuvier; and he, in comparison with the old figures of mysticetus, which we claim were nearer true than Scoresby's in general proportion, wisely admitted two species.

They were both, as we have said, about equally incorrect; yet they both had certain features that agreed with the descriptions of the two forms. The nordcaper had been described in nearly the same terms by various authors, great stress being laid on its slenderness and mobility. Scoresby now presents his figure, which, instead of being bulky, with a very short 'small,' or caudal region, and a head one-third the total, had quite nearly the proportions of the figure of Bachstrom, received by Cuvier as that of nordcaper, and with no other specific feature to distinguish them.

The mention of inaccuracies, seen near the close of the criticism, is not wholly free from error; for example: the citation touching Col. Hamilton and the Naturalists' library is exactly correct, yet it is noticed as one of the errors that render the historical *résumé* 'seriously defective and misleading.' We are now willing to rest this showing, trusting to the facts herein referred to for our vindication in the face of this grave charge. J. B. HOLDER.

Fortunately for Dr. Holder, he did not state directly and unequivocally that the St. Lawrence whale was a Balaena; but he occupies several pages in trying to explain away the obvious discrepancies in the way of such an identification and in offsetting them with the *possibilities* in its favor, leaving the reader with the conviction that the specimen is cited as, in Dr. Holder's opinion, an instance of the occurrence of a Balaena in the St. Lawrence near Quebec. Indeed, he goes so far as to say, "and the second example [the one here in question] . . . shows that the largest of the right whales [Balaena] have really found their way as far up a fresh-water stream as Quebec and Montreal" (p. 116). Again he says, "This example is valuable for record, 1°, as a specimen of unusual size; 2°, as one of great age; 3°, as one out of its usual habitat in so far as to be quite within fresh water" (p. 115). From the context, the point in doubt seems to be, not whether the species is a Balaena, but whether it is B. cisarctica or B. mysticetus; and the whole tenor of the argument (for such it really is) is fairly open to only this construction, whatever may have been intended. In evidence that my criticism on this point is not groundless, or due to perversity on my part, I may cite Mr. F. W. True's notice (*Scient. lit. gossip*, i. 72) of Dr. Holder's memoir, where the same criticism is made.

As to other points, I will take space to say merely that I regret to notice that Dr. Holder forgets to tell us where Scoresby got his drawings, which, he (Dr. Holder) informs us, 'were evidently ill-considered and taken at second hand,' and to ask for proof that Col. Hamilton wrote the 'Cetacea' of Jardine's 'Naturalists' library.' The copies of the work I have seen are anonymous, but the work is accredited by Gray and other cetologists to Jardine; and some time since, I took pains to satisfy myself that Jardine was the author. As to Godman, I confess to having done him injustice in overlooking his credit to Scoresby, which my friend Dr. Holder appears to have unfortunately only recently discovered; otherwise, doubtless my stricture on this point would not have been called out. J. A. ALLEN.

The Ainos of Japan.

On p. 307 of SCIENCE, D. P. Penhallow objects to my statement of the number of Ainos. It is rather surprising how little he heeds what I said. The numbers he gives are official; i.e., he gives the number of Ainos known to the Japanese government. Therefore he reaches the surprising result, that, with the exception of the Ainos brought over from Saghalien (now about 800), there are but 200 in all the province of Ischicari. That province is about as large as Hitaka (according to Penhallow, with 5,000 to 6,000).

Penhallow gives the Aino population in Kitami, Kushiro, Tokachi, and Teshiwo as ranging from 350 to 1,500 in each, when it is well known that they are full of Ainos, as any one travelling there will see, their villages being thickly scattered along the coast and the banks of all the larger rivers. I should estimate from those seen at such points that there must be more than 50,000 Ainos in all. Taking Penhallow's figures for Iburi and Hitaka as correct, and assuming that the four provinces named above must have as many Ainos as Hitaka, we should have about 26,000 in these five. Granting that Ischicari, Shiribeshi, and Nemuro have also been taken as much too thickly populated, still we must give them 4,000 more than Penhallow allows; i.e., about 6,000.

Now add to them Penhallow's number for Iburi, nearly 4,000, and the small remnant of Oshima, (Penhallow, 250), and lastly for Chishima (not Chisuma) or the Kuriles a minimum of 750, we get 33,000 as the minimum for Yezo. Saghalien having 10,000 to 12,000, and South Kamtchatka 5,000 to 6,000 (perhaps less), there cannot be fewer than 50,000 Ainos altogether. D. BRAUNS.

The Iroquois.

A close study of the Mohawks of Quebec province, Canada, after the plan and in the service of the Bureau of ethnology, reveals several facts hitherto unnoticed in the various histories of the Iroquois.

Isolated by the early Jesuit fathers from their former Pagan friends and surroundings, every trace of their old folk-lore and of their Pagan customs has disappeared. The division and nomenclature of their gentes differ materially from those of any of the other tribes, and present an interesting field of inquiry. The Mohawk gentes, as given by Morgan, are the wolf, bear, and turtle. Among the Mohawks at Oka, we find, in addition to those, the lark and the eel, while at Caughnawaga they are the bear, wolf, calumet, rock, lark, turtle, and dove.

Among the wampum belts of this tribe is a very fine one, upon which the calumet is figured in white

wampum beads, the remainder of the belt being in dark purple. This probably belonged to the gens bearing the name of the calumet, and whose office it was to prepare and present the grand calumet in all the solemn assemblies.

The effect of the isolation of this tribe upon its language is also an interesting and important study. Through the courtesy of Superior Antoine and Père Burtin, I have obtained access to an invaluable collection by the French missionary Marcoux, which will furnish Mohawk synonymes for a dictionary of the six Iroquois dialects, for which thirty thousand words have already been gathered. ERMINNIE SMITH.

203 Pacific Ave., Jersey City.

Many snakes killed.

The number of snakes killed near this city during the late overflow of the Nemaha River is almost beyond belief. They were driven by the water from the bottom-lands to the higher grounds, and especially to the embankments thrown up across the bottom for the Burlington and Missouri and the Missouri Pacific railways. It is estimated that more than three thousand snakes were killed within a mile of this town. They were chiefly garter snakes; but water moccasons, blue racers, and rattlesnakes were also killed. A horse was confined in a pasture surrounded by a wire fence in the overflowed district, and, when released, it was found that several snakes had taken refuge in the long hair of his mane. Since my residence here, I have travelled nearly all over this county, a portion of the time engaged in geological explorations; yet, up to the time of the present June overflow, I had failed to see half a dozen snakes all told. The overflowed district along the Nemaha would not average over a mile in width; and it is astonishing where so many snakes found hiding-places. Undoubtedly, nearly all the snakes in this county are confined to the creek and river bottoms.

STEPHEN BOWERS.

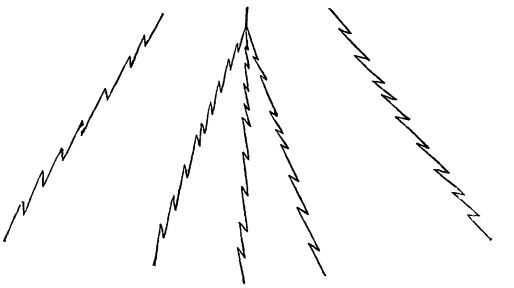
Falls City, Neb., July 10, 1883.

Swallows in Boston.

Has any one seen a swallow in Boston this summer? The old proverb says, 'One swallow does not make a summer.' Have we a summer and not one swallow? CARL REDDOTS.

Singular lightning.

On the evening of July 4, 1883, I noticed some lightning which differed from any that I have previously seen. About sunset a mass of very threatening clouds, accompanied by heavy rain and lightning of the usual character, rose in the north-west, and, following an easterly course, passed a little to the northward, giving us a few drops of rain from its ragged southern edge. It was quickly succeeded by a comparatively thin cloud-stratum, — apparently the after-birth of the main storm, — the course of which was directly overhead. During the passage of this cloud, rain fell briskly but not heavily for perhaps half an hour, and rather frequent flashes of lightning preceded and followed the first sprinkle. Owing to my position on the eastern side of a large building, I could not see the earlier flashes; but their light, thrown on the walls of neighboring houses, was noticeably rose-colored. At length, however, one came that could be accurately noted. It passed directly overhead, forking into five fine, thread-like lines of vivid yellow light. Each line was distinctly zig-zagged with sharp though not prominent angles. The divergence of the lines was nearly regular, but the outer pair branched at a greater angle than the inner three. The relative divergence was similar to that of the outstretched fingers of a human hand; but a still more accurate idea may be given by the following sketch.



The flash above described was followed, in a few minutes, by a second one, apparently similar, but less satisfactorily noted. After this the rapid passage of the storm carried the lightning beyond my limited space of observation.

I may add that none of the lightning from this cloud seemed to come to the earth, its course being on an apparently horizontal plane. The accompanying thunder was unusually deep and grand.

WILLIAM BREWSTER.

Cambridge, Mass.

Deflective effect of the earth's rotation.

In SCIENCE for March 2 (No. 4), Mr. W. M. Davis says, "A correct knowledge of the deflective effect of the earth's rotation is generally accounted the result of studies made within the last twenty-five years."

This correct knowledge, he says, is still disputed by some authors.

By transferring the axis of rotation to the tangent plane on which the body is supposed to move, and resolving the earth's rotary motion into two motions, — one around the meridian of the tangent plane, and the other around a vertical to that plane, — it is easily seen, without recourse to the equations of motion, that the angular motion of the tangent plane with respect to a fixed plane will depend upon the angular rotation of the earth and the sine of the latitude of the tangent plane; from which it follows that the deflective force is the same, in whatever direction the body is supposed to move on any given tangent plane.

But in resolving the actual motion into two motions, respectively around the vertical to the tangent plane and around the meridian of that plane, we have neglected the effect resulting from the latter, — a consideration of which would have introduced another term, containing a function of, and therefore varying with, the cosine of the angle contained between the meridian and the line of projection of the moving body; we have also neglected the effect of the centrifugal force resulting from the motion of the body, which is a minimum when the motion is in the meridian, and a maximum when at right angles to the meridian, and therefore also varies with the cosine of the angle contained between the meridian and the line of projection of the moving body. When the velocity is considerable, both these terms become sensible; and therefore the deflective force is least when the body moves in the meridian, and greatest when the motion is at right angles with the meridian.

This conclusion is in conflict with the 'correct knowledge' above alluded to; viz., that the deflec-

tion of the moving body depends 'not at all on the direction of its motion.' But I may remark, that Routh (see Rigid dynamics, p. 192) has also given the subject a rigorous investigation by means of the equations of motion, and finds for the deviation to the right, in north latitude, two terms, — the one agreeing with the above, as found from the component about the vertical; and the other, a function of the cosine of the angle contained between the meridian and the line of projection of the moving body.

J. E. HENDRICKS.

Des Moines, Io., July 16, 1883.

ALNWICK CASTLE ANTIQUITIES.

A descriptive catalogue of antiquities, chiefly British, at Alnwick Castle. Printed for private distribution. Newcastle-upon-Tyne, 1880. 11+210 p., 43 pl. 4°.

BY the generosity of the Duke of Northumberland, the Boston public library has recently been made the recipient of a copy of this truly magnificent work, and of the companion volume descriptive of the important collection of Egyptian antiquities, also preserved at Alnwick. In no more satisfactory manner could the liberality and public spirit of the noble proprietor have been manifested than in thus sharing his treasures with the antiquaries and art-lovers of other countries. Such sumptuous volumes as these constitute a monument *aere perennius*, like those which illustrate the literary and artistic treasures of Earl Spencer at Althorp, or the magnificent publications in which the Archduke Ludwig of Austria has recorded his travels.

In its artistic and mechanical execution, this catalogue is beyond praise: never have we seen more beautiful or more faithful delineations of the various kinds of antiquities. If we cannot speak in quite such high terms of commendation of the accompanying letterpress, the fault should not be laid to the charge of Dr. Collingwood Bruce, upon whom devolved the task of preparing the work for the press. His competency as an antiquary has been sufficiently manifested by his able and thorough study of 'The Roman wall,' whose 'stations' have yielded to the explorer many of the objects described in the volume. It is to the untimely death of Mr. Albert Way, by whose assistance and advice much of the collection was gathered, who knew its contents thoroughly, and to whom the preparation of the catalogue had been originally intrusted, that any shortcoming must be attributed. Although several distinguished English antiquaries have lent their aid to the editor in their respective departments of knowledge, we miss the influence of one guiding mind, familiar with the results of recent archeological research in all its various branches, and capable of 'speaking the latest word' upon the many interesting and important topics suggested. Still the reader cannot fail to receive instruction from the accounts given of numerous relics of various periods in the ages long since past, while the beauty of many of the objects delineated goes far to justify the claim that, —

> "Not rough nor barren are the winding ways
> Of hoar antiquity, but strewn with flowers."

The expression 'chiefly British' in the title must be understood to mean that the greater part of the antiquities described have been found in Great Britain. Those first represented belong to the prehistoric periods of stone, of bronze, and of iron, and consist mainly of weapons and implements, such as axes and celts of stone, and swords and celts of bronze, or of a great variety of those rude, hand-made, sepulchral vases found in grave-mounds, in which was stored a supply of food for the dead. To the same remote ages are to be ascribed those singular markings found upon stones, known to archeologists by the name of 'cup-cuttings,' of which two remarkable examples occurring in Northumberland are represented. They are found in countries widely separated, and everywhere they closely resemble one another, and they have greatly exercised the minds of antiquaries as to their origin and significance. They consist of a series of shallow pits or cups, incised upon ledges, or, more frequently, upon bowlders. Of these, a central one is often found surrounded by one or more concentric circles; and a characteristic feature of such groups is a longitudinal groove extending from the central cup to beyond the outermost of the circles that surround it. That they are religious emblems is generally conceded, as the same kind of markings is found upon the slabs of stone of which ancient graves have been constructed. It is highly probable that they are a conventional representation of a primitive system of nature-worship that prevailed among our Aryan ancestors, symbolizing the mysterious origin of life. The whole subject has recently been treated in the most able and exhaustive manner by the learned archeologist of the Smithsonian institution, Mr. Charles Rau, in the fifth volume of Major Powell's 'Contributions to American ethnology.' We cannot help feeling surprised that the editor, while quoting largely from Sir James Simpson's 'Archaic sculptures,' makes no reference whatever to the late Professor Edouard Desor of Neuchâtel, whose various writings

upon *Les pierres à écuelles* have shed much light upon this obscure subject.

Another strange problem bearing upon this vexed question of early religious symbols is but just touched upon in this volume. We refer to the use from a very remote period, either for emblematic or decorative purposes, of a peculiar form of cross, resembling the Greek letter gamma four times repeated. This has been called by various names,  — the 'digammated cross,' or 'gammadion;' in the middle ages the 'fylfot;' and recently, by Sanscrit scholars, the 'swastica.' M. Burnouf believes that this, also, is a primitive religious symbol of the Aryan races, and that it represents the two pieces of wood which in early times were laid crosswise before the sacrificial altar in order to produce the holy fire, having their ends bent at right angles and fastened in such a way as not to be moved. Where the pieces crossed there was a small hole, in which a third piece of wood was rotated by means of a cord until fire was generated by friction. This sign occurs upon two Roman altars figured in the volume, which have been transferred to the museum at Alnwick from neighboring stations upon the Roman wall, where they had been disinterred. Several references are given to authors who have treated of this emblem, — among them, to Dr. Schliemann, who found it at Hissarlik upon 'whorls' of baked clay; and the statement is made, that it eventually came to have a Christian signification, and is found in the catacombs at Rome in conjunction with the usual Christian symbols. The elaborate study, however, by De Mortillet, entitled *Le signe de la croix avant le christianisme*, is entirely overlooked, in which its occurrence is traced down from the 'terremares' of the age of bronze, in Emilia, in upper Italy.

A unique object represented is an example of the so-called 'chrisma,' the monogram formed by uniting the first two Greek characters of the name Christ, X and P. This combination had long been in use as an abbreviation of different words, and it is  found upon the coinage of various eastern nations. Constantine placed it upon the 'Labarum' as a Christian emblem; and it is often met with upon his coins and those of his immediate successors, and upon terra-cotta lamps found in the catacombs at Rome and elsewhere. Three, at least, of such ancient Christian lamps, have been discovered in England; but the rarity of the present example consists in the fact that it is embossed upon the outside of a little drinking-cup made of red clay. This is of the very uncommon kind of pottery occasionally brought to light in England, which was manufactured by the Romanized Britons at Caistor, in Northamptonshire, the Durobrivae of the Romans. It is used as an ornament in association with a very well executed representation of the coursing of a hare, and it is probably to be referred to about the middle of the fourth century.

Several fine specimens of ancient Roman fictile ware from Pompeii are delineated, as well as those found in Great Britain, among them handsome lamps and facsimiles of the potter's stamps, which are often found impressed upon their under side. Such stamps were also usually placed upon the bottom of the finest kind of table-ware that was manufactured by the Romans, — that called 'Samian ware' from the place of its origin, but of which the best quality was fabricated at Arezzo, and spread by commerce over the whole Roman world. It is of a lustrous coral color, and often has embossed upon the outside, figures of different deities, or of men and animals, especially of those gladiatorial scenes of which the Romans were so fond. These figures were fashioned in moulds, many of which have come down to our own times, and are of a high grade of artistic merit. Frequently, however, the ornamentation consists only of harmonious conventional patterns, or of a scroll-work of leaves and vines of much grace and beauty of design. The potter's stamp sometimes contains the whole name, sometimes only initials, and occasionally it consists merely of some symbol. One figured in the volume is a representation of 'a tiny human foot,' which the editor thinks is "probably a rebus upon the name of the potter, which may have been CRASSIPES." This is rather an unfortunate conjecture, as it was a special whim of some of the potters of Arezzo to have their stamps made in the shape of a human foot. They are found in this form containing a variety of names, as well as no name at all. The writer has in his possession at least twenty different inscriptions of this sort.

It is certainly remarkable that only in England have there been found, it would appear, any specimens of the actual shoes or sandals worn by the Roman soldiers. One such is represented from the ruins of one of the camps that mark the line of the Roman wall. Similar discoveries upon such sites are recorded, and a few of these objects have been found in the bed of the Thames at London. The writer saw several that came to light in London in 1873, in excavating the foundation for a large building in the heart of the 'city.' On that

occasion the ditch that surrounded the fortified Roman town was laid bare, formed out of the natural bed of a little brook, and in it these and many other curious relics were found. These ancient Roman shoes are singularly like modern ones in pattern and mode of fabrication; and, in consideration of their wonderful state of preservation, they would seem to justify the cobbler's proverb, 'There's nothing like leather.'

Among the 'medieval remains,' we find figured and described 'a bronze eagle with uplifted head and open mouth.' The bird, however, strongly resembles one represented in *Archaeologia*, vol. 46, pl. 17, that was discovered in the recent excavations at Silchester in 1870. This, the late John Richard Green, in his Making of England, calls "a legionary eagle, hidden away, as it would seem, in some secret recess, and there buried for ages to tell the pathetic tale of the fall of Silchester." In Horsley's Britannia romana, there is also figured a similar bronze eagle discovered in England. It is true, that the Roman eagles that are delineated upon Trajan's Column and upon the Arch of Constantine are represented with expanded wings, and that Montfaucon and recent writers upon classical antiquity, copying him, have stated that they were *invariably* made in this manner. All three of these birds, however, have their wings folded, from which we may infer that the other fashion of representing them may have arisen in part from the exigencies of pictorial art.

We have an example given of one of those singular seals, in the shape of a monkey perched upon a cube, made of a peculiar kind of porcelain, and bearing an inscription in ancient Chinese characters, such as are occasionally found in the bogs in various parts of Ireland. At first they were believed to be of remote antiquity; and it was even supposed that they had been brought into the country by the Phoenicians, since it was asserted that they are not to be found in China at the present time. But this is not the case, as they can now occasionally be procured of the dealers in curiosities in that country. The inscriptions are engraved in an antique character, now only employed for seals, and known as the 'seal character.' Frequently they consist of some poetic quotation like the one given: 'When the water falls, the rocks appear.' Their presence is undoubtedly due to modern commerce, though not of a very recent period. In this particular they resemble the little Chinese bottles used for holding snuff, which are found in ancient Egyptian tombs, one of which is preserved in the museum at Alnwick. They are about two inches in height, and have on one side a flower, and on the other an inscription, which on several specimens reads, 'The flower opens; lo! another year!' This is known to be a quotation from a poet who lived in the eighth century P.C., and the object evidently was intended for a New-Year's gift. Instead of proving, as Rosellini supposed, the existence of a commerce between the two countries in Pharaonic, or at all events in Ptolemaic times, it is now known that they were brought to Egypt in the middle ages by caravans from western China. They are not of exceeding rarity, as Sir Gardner Wilkinson states that he has seen more than twenty of them, found in the tombs at Thebes and other places, and the writer has half a dozen obtained in Cairo.

Unquestionably the most pleasing object delineated in the volume, and one of the glories of the collection, is the well-known 'Rudge cup.' This is a little bronze vessel, about four inches in diameter and three in height, of a simple bowl shape, and adorned in the most tasteful manner with different colored enamels, in the style called *champlevé*. In this, the metallic field is cut away so as to produce cavities, in which is inserted the paste that becomes vitrified upon being subjected to heat. The ornamentation consists of a series of panels made up of four squares of various colors, alternating with compartments containing four crescents of different hues, set back to back. The colors are turquoise and dark blue, beautifully contrasted with a narrow border of pale red, which outlines and separates the several compartments. Around the top runs an inscription which is supposed to contain the names of several localities lying along the line of the Roman wall, but which has thus far proved a puzzle to the interpreters. It was found in the year 1725, at a place called Rudge Coppice, near Froxfield, in Wiltshire, in a well near the site of some Roman ruins. The well was filled with rubbish; and in it were also found four or five human skeletons, some animal bones, and several coins of the lower empire. It is described as merely 'a remarkable relic of the Roman times;' but this would appear to be a very unmeaning designation, when we call to mind the fact that 'relics' of this description are never discovered in Italy. It may be worth the while to give a brief account of the more important specimens of ancient *champlevé* enamelling that have come to light in Europe, and to state what is known or surmised in regard to their probable origin and place of fabrication.

For purposes of comparison, the editor has given an engraving of an enamelled bronze cup, of similar shape and method of manufacture, which was found at Harwood, in Northumberland, and is now in the British museum. He also describes a facsimile cast of a beautiful vessel, known as the 'Bartlow vase,' the original of which was nearly ruined in a fire which took place in the mansion of Lord Maynard, by whom it was discovered in 1832, during excavations made in a series of remarkable flat-topped tumuli situated at Bartlow, in Essex. A plate showing it in all its pristine beauty may be found in *Archaeologia*, vol. 26, pl. 35. It is now in the British museum, where can also be seen a similar vase, discovered at Ambleteuse, near Boulogne. Still another of the same character, found in the western part of France, is preserved at Angoulême. Finally in the *Mémoires de la société des antiquaires du nord*, n.s., 1868, there is represented an exceedingly beautiful specimen of an enamelled bronze cup of the same pattern, discovered in 1867 in a peat-moss at Maltboeck, in the southern part of the peninsula of Jutland, in Denmark.

Beside these vases, enamelled fibulae and horse-trappings have frequently been found in ancient graves, especially in England. Professor Boyd Dawkins, in his Cave-hunting, also gives a plate representing several brooches of this kind, which were discovered during the explorations of the Victoria cave, in Settle, Yorkshire. This was so named on account of its discovery upon the coronation day of Queen Victoria, in 1839; and it is especially interesting as having been a place of refuge of the miserable British fugitives who fled before the sword of the 'conquering Engle.'

The art of enamelling was known to the ancient Egyptians, the Etruscans, and the Greeks; but the last had ceased to make use of it at least two hundred years B.C. By the Romans it was never practised at all; and it is not alluded to by Pliny in his encyclopedic 'Natural history.' The only reference to it to be found in any ancient author occurs in the *Imagines* of Philostratus the elder (lib. i., im. 27). In a description of a picture of a boar-hunt, after enumerating the different colors of the horses ridden by the youthful huntsmen, and saying that the bits were of silver and the housings enriched with gold and various colors, he adds, "They say that the barbarians, who dwell near the ocean, pour these colors upon heated brass, and that they adhere, and become like stone, and preserve the designs made by them." Now, Philostratus was a Greek rhetorician, called from Athens, in the beginning of the third century, to the court of Julia Domna, wife of the emperor Septimius Severus. As this emperor passed considerable time in Britain, where he built, or at any rate repaired, the wall that goes by his name, and died at York, it is by no means improbable that Philostratus gained his knowledge of the processes of enamelling from accounts brought to the court from that region. To the English antiquaries it seems to be established, by the number and the beauty of such objects that have been discovered in their own country, that this was the principal seat of its manufacture; and Mr. John R. Green does not hesitate to call the 'party-colored enamel the peculiar workmanship of Celtic Britain.' But from the fact that the late Abbé Cochet has found precisely similar enamelled objects in his explorations of ancient cemeteries in Normandy, and from the discovery of cups of the same kind upon the soil of France, the antiquaries of that nation maintain that their own countrymen were 'the barbarians that dwelt near the ocean.' *Non nostrum tantas componere lites;* but certainly objects of this character ought never to be styled 'Roman.'

We wish that we had more space at our disposal to direct attention to the many other beautiful objects of antiquity to be found in this fine collection. HENRY W. HAYNES.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

Linear differential equations. — M. G. Floquet, in a paper entitled "*Sur les équations différentielles linéaires à coefficients périodique*," has made an interesting and seemingly important addition to the literature of periodic functions. He considers a homogeneous linear differential equation of the form

$$P(y), = \frac{d^m y}{dx^m} + p_1 \frac{d^{m-1} y}{dx^{m-1}} + p_2 \frac{d^{m-2} y}{dx^{m-2}} + \ldots + p_m y = 0,$$

the coefficients being uniform functions having all the same period, ω, and the general integral being supposed uniform. If the variable be changed by the substitution

$$e^{\frac{2\pi i x}{\omega}} = \xi,$$

the result is a linear transformation of P, in which the coefficients are uniform functions of ξ. From the known expression for its integrals in the region of a

singular point, we may, by giving ξ the above value, vary the form of the solutions of $P(y) = 0$. The author prefers, however, to treat the question directly, inasmuch as he is thus enabled to employ many of the results arrived at by M. Fuchs, and as he can use processes identical with those employed by Fuchs in his study of the integrals around a singular point. M. Floquet obtains thus a fundamental system, S, of solutions connected with a certain algebraic equation, $\Delta = 0$, which he calls *the fundamental equation relative to the period* ω; the first member of $\Delta = 0$ is a determinant of degree m with respect to the unknown ε. The elements of the system S constitute as many *groups* as the equation $\Delta = 0$ has distinct roots; and, by applying a process due to M. Hamburger, these groups are divided into *sub-groups* which are mutually independent. The particular conclusions arrived at are as follows. I. Let $\varepsilon_1, \varepsilon_2 \ldots \varepsilon_n$ denote the distinct roots of $\Delta = 0$; let λ_i denote the order parting from which the minors of Δ cease being all zero for $\varepsilon = \varepsilon_i$. 1°. $P = 0$ admits as distinct integrals $\lambda_1 + \lambda_2 + \ldots + \lambda_n$ periodic functions of the second kind, and no more. 2°. There exists a fundamental system of solutions, including, first, $\lambda_1 + \lambda_2 + \ldots + \lambda_n$ periodic functions of the second kind; second, $m - (\lambda_1 + \lambda_2 \ldots + \lambda_n)$ expressions, each having the form of an integral polynomial in x, and having for coefficients periodic functions of the second kind possessing the same multiplier. 3°. The multipliers of the periodic functions which appear in the fundamental system, either as elements or as coefficients in the elements, are equal to the different roots $\varepsilon_1, \varepsilon_2 \ldots \varepsilon_n$ of the fundamental equation. II. In order that $P = 0$ may have m periodic functions of the second kind as distinct integrals, it is necessary and sufficient that each of the roots of $\Delta = 0$ shall annul all the minors of Δ up to those of an order equal to the degree of the multiplicity of each root. In the above, a periodic function of the second kind, with a period ω, means a function defined by relation $F(x + \omega) = \varepsilon F(x)$; ε is the multiplier; and, if $\varepsilon = 1$, the function is said to be periodic of the first kind. — (*Ann. l'école norm. sup.*, Feb.) T. C. [134

PHYSICS.

(*Photography.*)

The effect of pressure on the gelatine film. — Capt. Abney has shown, that, if pressure is applied to the sensitive surface of the gelatine plates, the same result is obtained as if the plate had been exposed to the light. The editor of the *British journal of photography*, experimenting further, finds that abrasion, such as may be produced by the motion of a glass rod drawn out to a fine rounded point, is necessary to the action, and that mere pressure, such as would be obtained by a carpenter's vise, produces no effect whatever. A stripped film was next placed upon the other one, and the markings made with the rod upon it, with very heavy pressure. On development with pyro, no effect was at first produced; but, by prolonged action, a green fog was created in the adjacent regions of the film, leaving the figures clear on a dark ground. — (*Brit. journ. phot.*, June 15.) W. H. P. [135

Electricity.

Unipolar conductivity. — Hugo Meyer confirms the result previously obtained by him, that the mineral psilomelan possesses the curious property of unipolar conductivity for electricity. He finds, also, that the resistance to a constant current is independent of the duration of the current, and that different specimens of the mineral are radically different in electrical properties: hence the inconsistent results of different observers are admissible. — (*Ann. phys. chem.*, xix. 70.) J. T. [136

A cheap bolometer. — C. Baur describes a thermoscope which consists of thin gold leaves blackened with platinum chloride, and cut so as to combine large surface with low resistance. These are attached to opposite ends of a cylinder which is hollow and open at the ends, and solid in the middle. These leaves are made the arms of a Wheatstone bridge, and prove to be a much more delicate test for radiant heat than the thermopile. The author terms the instrument a radiometer. — (*Ann. phys. chem.*, xix. 12.) J. T. [137

Measurement of the ohm. — J. Fröhlich describes a 'dynamometric' method of measuring the ohm: the secondary coil is balanced on a rigid horizontal arm, suspended bifilarly so that the plane of winding is perpendicular to the meridian; opposite is placed the inducing coil, in which, by an ingenious arrangement of keys, the current is made, shunted, and broken without a spark. The consequent attractions and repulsions are measured by the swinging of the suspended apparatus. From a preliminary experiment, the author is encouraged to consider the method a practical one. — (*Ann. phys. chem.*, xix. 106.) [138

ENGINEERING.

Engines of lake steamers. — One of the steamers of the Western transportation line has engines of the 'compound' type, two low and two high pressure cylinders, of 20 and of 40 inches diameter and of 40 inches stroke. The steam is cut off at 8 inches in the high-pressure cylinder, and the consumption of steam amounts to but 19 pounds per hour and per horse-power. The boat is 256 feet long, 38 feet beam, and 16 feet draught. The engines and boilers weigh about 100 tons. The latter have 100 square feet of grate-surface, and 3,366 square feet of heating-surface. Another vessel, the E. B. Hale, has simple engines, carries 1,600 tons of freight at 14 feet draught, makes about 10 knots an hour on 1,400 pounds of coal. The engines are 36 by 36, and are supplied with steam by one boiler 12 feet in diameter by 18 feet long. — (*Mechanics*, June 23.) R. H. T. [139

Heating by superheated exhaust-steam. — Mr. Levi Hussey has devised a method of heating buildings in winter by the exhaust-steam from engines by first passing it through a superheater in the flue, and there taking up heat which would otherwise be sent up the chimney and wasted. The steam is thus deprived of all moisture, and then heated to so high a temperature that it will heat more thoroughly, and with less obstruction by back-press-

ure, than saturated and wet steam. Heat is thus obtained without cost, and rendered effective for useful application to a greater extent than has hitherto been possible. — (*Amer. mach.*, July 7.) R. H. T. [140

CHEMISTRY.

(*Analytical.*)

Electrolysis of bismuth solutions. — Messrs. N. W. Thomas and E. F. Smith find that bismuth may be accurately determined in solution either as sulphate or as citrate by electrolysis. By three bichromate cells all the bismuth was deposited in a compact form in three hours. It was washed, first with water, then with alcohol, dried, and weighed. The reduction goes on equally well in a solution containing an excess of citric acid. — (*Amer. chem. journ.*, v. 114.) C. F. M. [141

Estimation of hardness in water without soap solution. — Instead of the usual method for estimating the hardness of water, O. Hehner prefers titration with standard sulphuric acid and sodic carbonate solutions. He claims that the results obtained with the soap solution are very variable and wholly unreliable. — (*Analyst*, May, 1883.) C. F. M. [142

The presence of copper in cereals. — In an article on this subject, Mr. E. F. Willoughby reviews the instances in which copper has been found in cereals, and he quotes the following results obtained by Dr. V. Galippe: —

	Copper in a kilogram.
Wheat from Central France	0. 0100 grm.
" " La Châtre (Indre)	0. 0080 "
" " Grand Villiers (Oise)	0. 0052 "
" " Michigan	0. 0070 "
" " America (Redwinter)	0. 0085 "
" " California	0. 0050 "
" " Native Bric	0. 0054 "
" " America, soft	0. 0108 "
" " Russia, hard (Taganrog)	0. 0088 "
" " Algiers, hard	0. 0062 "
Rye	0. 0050 "
Oats	0. 0084 "
Barley	0. 0108 "
Rice	0. 0016 "

— (*Analyst*, May, 1883.) C. F. M. [143

AGRICULTURE.

Preserved milk. — Loew found that a sample of milk which had been sealed up and heated to 101°, and then preserved for eight years, had undergone decided change. The color was brownish, and the taste intensely bitter. The milk-sugar was changed into dextrose and levulose; the caseine and albumen, into peptone. A sediment yielded crystals of tyrosin after boiling with potash. Milk preserved for a year by Scherff's process was found by Vieth considerably altered in taste, but samples kept in a cool cellar for several months appeared unaltered. — (*Bied. centr.-blatt.*, xii. 57.) H. P. A. [144

Calculation of feeding-rations. — In two feeding-experiments with steers, Caldwell and Roberts found that a ration calculated to correspond to that recommended by Wolff for maintenance caused a very decided and steady gain in weight, while a richer ration gave much greater gains than have been obtained by other experimenters from rations calculated to furnish the same amounts of digestible matters. They conclude that "We have not yet sufficient data, from actual feeding-experiments, upon which to base a reliable calculation of the maintenance-ration, or of a ration for the production of a certain effect." — (*Rep. Cornell univ. exp. stat.*, 1882–83, 18.) H. P. A. [145

Determination of proteine. — Trials of Stutzer's method of separating true proteine from other nitrogenous matters failed to give Newbury concordant results in the case of several concentrated fodders, and numerous difficulties in manipulation were experienced. With coarse fodders the results were concordant. — (*Rep. Cornell univ. exp. stat.*, 1882-83, 34.) H. P. A. [146

Determination of phosphoric acid. — Pemberton's method for the volumetric determination of phosphoric acid in fertilizers by titration with a standard solution of ammonium molybdate gave results closely agreeing with gravimetric determinations. Two improvements in the process are described. — (*Rep. Cornell univ. exp. stat.*, 1882–83, 29) H. P. A. [147

MINERALOGY.

Peculiar crystals of fluorite. — On a hand specimen of fluorite, probably from Zinnwald, Bohemia, F. J. P. Van Calker noticed that there were on all of the small crystals, which were combinations of cube, hexoctahedron, and octahedron, well-defined markings on each cubic face, making a perfect rectangle whose sides were parallel to the intersection of the cube and octahedron. To account for these peculiar markings, which were present on all of the crystals, the author suggested that each crystal might originally have been of a simpler form, around which a subsequent shell of fluorite had been deposited; and a section from a single crystal, cut near and parallel to a cubic face, showed, when examined by transmitted light, a colorless centre, with the rectangular marking appearing as a dotted line, and outside of this another colorless portion completing the crystal. This fully confirmed the author's suggestion of an enclosure of fluorite in fluorite, showing that the crystals were originally of simple form, combinations of cube and octahedron, which had become coated with some pigment, and subsequently another deposit of fluorite had taken place, building up the hexoctahedron planes on all of the solid angles. — (*Zeitschr. kryst.*, vii. 447.) S. L. P. [148

GEOLOGY.

Lithology.

The eruptive rocks of Tryberg, Schwarzwald. — George H. Williams has published for the doctorate degree a valuable petrographical paper on the Tryberg region, the country rocks of which are gneiss, granitite, and granite, cut by dikes of granite, quartz-porphyry, mica-syenite-porphyry, mica-dio-

rite and nepheline-basalt, while porphyrytuff occupies a portion of the Kesselberg area. The granitite is a crystalline granular mixture of felspar, quartz, and biotite, and is regarded as a typical rock of its kind. The quartz-porphyry has a compact, red groundmass porphyritically enclosing quartz and felspar, also biotite, apatite, and magnetite. The mica-syenite-porphyry has a compact, deep reddish-brown groundmass, holding biotite and felspar, as well as some quartz, apatite, and zircon.

The nepheline-basalt shows a compact, greenish-black groundmass, holding crystals and grains of a fresh, nearly colorless olivine. The groundmass is composed of a mixture of augite, little olivine crystals, and magnetite grains cemented by a colorless mass of nephelite and glass. Some reddish-brown biotite was observed, while apatite in little needles occurs abundantly. The paper is accompanied by a plate and map, while the classification followed is that of Prof. Rosenbusch of Heidelberg, with whom Dr. Williams studied. This classification of eruptive rocks is now the prevailing one in Germany, and, on account of the number of Rosenbusch's students connected with the U.S. geological survey and with other institutions, will be soon generally used in America. — (*Neues jahrb. min., beil.*, 1883, ii.) M. E. W. [149

GEOGRAPHY.

(*Arctic.*)

Danish expeditions in Greenland in 1883. — Dr. Rink, who is now resident in Kristiania, gives some details as to the proposed work for this season. Lieut. G. Holm, assisted by Lieut. Garde, geologist Knutsen, botanist Eberlin (who also acts as surgeon), and a number of Greenlanders, will undertake the exploration of the eastern coast of Greenland in umiaks, in the narrow strip of water between the great stream of drift-ice and the shore, where these boats may be able to accomplish much not practicable for a vessel. They will endeavor to pass the northern extreme reached by Graah, 1828–30, and to penetrate to the interior by some of the deep fiords, thus obtaining some idea of the region between them and the western coast. The other expedition will endeavor to map the unexplored portion of the western coast between 67° and 70° N. lat., and will be commanded by Lieut. Hammer, assisted by Sylow as geologist, and naval Lieut. Larsen. Notice has already been taken of the arrival of these parties in Greenland. — (*Naturen*, Mai, 1883.) W. H. D. [150

(*South America.*)

The death of Crevaux. — The details of the destruction of this gallant explorer and his party have been obtained from a native interpreter, who was made captive at the time, but finally escaped across the desert to Ankaroinga. The party had arrived at a spot on the right bank of the Pilcomayo, five leagues above the Rio Tigre, where there is a village of Toba Indians called Cuvarocai. After having been assured of a peaceful welcome, the doctor began to distribute presents to the natives, who, at the advice of their chief, rendered covetous by the sight of the valuables in the hands of the party, fell suddenly upon the explorers, and killed those on the shore. Those still in the boats attempted to escape by swimming, and were pursued, and several of them killed in the water. Only two, Haurat and Blanco, being good swimmers, succeeded in reaching the opposite shore, and hiding themselves in the forest. Nothing has been heard of them since. The interpreter was carried off as a prisoner. The bodies were thrown into the water or left where they fell, except that of Dr. Crevaux, which was carried to a neighboring village, where for thirty-six hours the Tobas sang and performed incantations around it, after which it was conveyed to a spot near to and visible from the huts. The Argentine government has sent Col. Sol with two hundred men up the Pilcomayo to punish the assassins, while the geographical society of Buenos Ayres has sent one of its number to search for the two survivors, and report on the whole subject. — W. H. D. [151

Crevaux's voyages in Guiana. — Henri Froidevaux summarizes previous investigations of the rivers of Guiana, and narrates the advances due to Crevaux. He notes that the indigenous population of Guiana is visibly decreasing, and states that Crevaux believed, that, judging by the abundance of village sites and relics on the river-banks now absolutely depopulated, there was formerly an abundant population. — (*Rev. géogr.*, May, 1883.) W. H. D. 152

Notes. — Dr. Güssfeldt has made interesting trigonometrical surveys in the Cordillera, together with observations on glaciers. He will soon take up the region about Aconcagua. —— The English brothers Haspold, with the warmest approbation of the government of the republic, have undertaken a very exact geological, mineralogical, and natural history survey of the different Argentine states. — (*Mitt. geogr. ges. Wien*, xxvi. no. v.) W. H. D. [153

(*Africa.*)

Number of Jews in Africa. — According to the estimate of Brunialti, the Jews in Africa number 450,000. Gerhard Rohlfs criticises this as much too high, and, by reviewing the estimates of population in all parts of the continent, concludes that 220,000 is much nearer the truth. — (*Peterm. geogr. mitth.*, 1883, 211.) W. M. D. [154

The coast-line of Tunis. — In his description of the Mediterranean lands, Th. Fischer has included Tunis in the area of rising coasts about Sicily, Sardinia, and south-eastern France. The correctness of this is questioned by Dr. J. Partsch of Breslau, who presents a considerable mass of evidence to show that the Tunisian shores have not changed their altitude in the historic period, although their outline has varied distinctly at certain points by delta growth. The river Medjerda (the ancient Bagradas) has shifted its mouth several miles to the north, and built out its delta into the Gulf of Tunis; and this in combination with the wind-action, by which sand has been blown inland from the shore, has added nearly one hundred square miles of lowland outside of the coast-line of the third century before Christ. Former lines of river-flow are distinctly visible at

several points. But all this, and other facts of a similar nature, must not be explained by an elevation of the land; for the ruins of Carthage, on a promontory a few miles to the south, are still close to the sea, and the remains of some of its harbor-works are yet at the water's edge. A variety of ancient and modern descriptions of this region are referred to. — (*Peterm. geogr. mitth.*, 1883, 201, map.) W. M. D. [155

ZOÖLOGY.

Protozoa.

New sporozoon. — A. Schneider has discovered in the Malpighian vessels of Blaps an amoeboid parasite. Multiplication takes place principally by means of cysts. Encystment occurs only between individuals with a single nucleus and of spherical form. The two conjugated organisms secrete around themselves several envelopes, each marked with an equatorial line of dehiscence. Each of the two nuclei divide into three. Of the six nuclei thus formed, four, together with a part of the granular mass, remain unused, while the other two become the spores. The species is named Ophryocystis Bütschlii. — (*Comptes rendus*, 1883, 1378; *Ann. mag. nat. hist.*, xi. 459.) C. S. M. [156

Insects.

Observations on Hymenoptera. — In part x. of his Observations, Lubbock answers some of Dr. Müller's objections to his methods in studying the color-preferences of the hive-bee, believing that his conclusions are not invalidated by them. To test the sense of hearing in bees, telephonic communication was established between two sets of bees, one of which was then excited, but with no effect on the other. Others were accustomed to visit honey placed near a music-box, the position of which was several times changed. The bees did not, however, appear to hear the music, though they seem to have connected the presence of the instrument with that of the honey, and were guided by it, even if it were not playing, so long as they could see it; but if they could not see it, even if it were playing, it did not assist them. It is, however, uncertain but that high over-tones, beyond our range of hearing, may be audible to bees.

Further experiments seem to show that the industry of wasps has been underrated. One individual visited some honey no less than a hundred and sixteen times in a day, loading herself each time, and carrying away more than sixty-four grains of honey. Her working-hours extended from 4.13 A.M. to 7.47 P.M., while a bee, working on honey the same day, made but twenty-nine visits, between 5.45 A.M. and 7.15 P.M.

A curious demonstration of the recognition of the queen by worker-ants was made in the following way: "I was starting a new nest of Lasius flavus in which were two queens. We allowed the ants to take one of them into their new glass house; the other we kept with a small retinue in a separate bottle. If this bottle is placed near the nest, some of the retinue leave it, go into the nest, and soon the ants come out in large numbers to see, I had almost said to pay their respects to, their queen."

The dislike of ants for the ultra-violet rays of the spectrum, indicated by earlier experiments, was further shown by the use of two screens, — one consisting of a solution of iodine in carbon bisulphide; the other of indigo, carmine, and roseine, mixed so as to produce the same tint, but not, like the bisulphide solution, intercepting the ultra-violet rays. The ants collected, in most instances, under the iodine screen.

The record of the occurrence of Ponera contracta in England, and the description of a new Australian honey-ant, Melophorus Bagoti, are of interest to the systematist. — (*Journ. Linn. soc., zoöl.*, xvii.) W. T. [157

(Economic entomology.)

Insects affecting the strawberry. — Professor S. A. Forbes summarizes what has been published respecting the insects that infest the strawberry in the United States, and adds original observations respecting several of them. These observations refer chiefly to the crown-borer, the root-worm, and the crown-miner. A very useful calendar is given, indicating in a concise form the periods of each of the species discussed and the particular place in which each insect occurs in each of its stages. — (*Trans. Miss. Valley hort. soc.*, 1883.) J. H. C. [158

The hop-vine borer. — Although this pest has been very destructive for many years, the life-history of the species has not been known till now. Prof. Comstock gives an account, with figures, of the insect in each of its stages. — (*Amer. agric.*, June, 1883.) [159

VERTEBRATES.

Are the lungs air-tight? — That the lungs are normally air-tight under the ordinary condition of life has been accepted in physiology as an almost necessary consequence of the function which they perform. Ewald and Kobert have lately reported some experiments which appear to show that this belief is not strictly correct. If the intra-pulmonic pressure is raised above a certain limit, not higher than may occur normally during life, there is an escape of air from the lungs into the pleural cavity or into the blood-vessels of the pulmonary circulation. When a curarized dog was exposed to artificial respiration at a proportionally high pressure for about an hour, the dog killed, and the chest opened under water, both the pleural cavity and the heart were found to contain air. Experiments made upon excised lungs, expanded under water by positive pressure, showed, that, at a certain pressure, air escaped, while, if the pressure was again lowered, the lungs again became air-tight. The authors satisfied themselves in all cases that there was no actual gross rupture of the lung-tissue or blood-vessels. The maximal expiratory pressure which a dog can produce was found to vary between 50 mms. and 90 mms. of mercury; while, to get an escape of air into the pleural cavity or heart, it was only necessary to keep the intra-pulmonic pressure at about 35 mms. of mercury. A similar result was obtained with rabbits. The escape of air

may take place not only through the walls of the alveoli, but also through the trachea, with the production of emphyaema of the subcutaneous cellular tissue of the neck, which in time may spread as far as the extremities of the body. The peculiar pains in the chest which sometimes follow upon violent expiratory efforts may be owing, they think, to a small escape of air into the pleural cavity. So many hitherto inexplicable cases in which, after sudden death, air has been found in the heart or pleural cavity, although there was no evidence of any rupture, may be explained in this way by the escape of air through the lung-tissue. — (*Pflüger's archiv*, xxxi. 160.) W. H. H. [160

Structureless basal substance. — The structureless substance which forms the basis of the 'jelly' in medusae, Emery thinks, is still represented in the higher animals, preceding in certain places the true connective tissue. Emery employs the name given by Hensen, 'tissue of secretion,' it being supposed to be secreted by the surrounding epithelia. In vertebrates an anhistic layer in the cornea precedes the true connective tissue (Kessler, Emery). In the embryos of teleosts, particularly those that leave the egg early, the ectoderm is separated by a thick layer of homogeneous, unorganized matter from the inner tissues. This hyaline mass also fills out the embryonic median fins. It is probably changed later into connective tissue by the immigration of cells. The clear membranes separating two adjacent epithelia, or an epithelium from connective tissue, the vitreous humor, and the substance filling the segmentation cavity of the ovum, are also, perhaps, to be enumerated here as preservations of a very ancient primitive formation, — the tissue of secretion of the most distant ancestors of vertebrates. Its excessive development in teleost larvae is probably an acquired embryonic characteristic. This interesting little paper especially deserves attention from those studying the embryology of fishes. — (*Arch. ital. biol.*, iii. 37.) C. S. M. [161

Fish.

Motor-nerve endings. — Ciaccio has investigated the motor-nerve plates in the depressor muscle of the jaw of Torpedo marmorata by treatment with double chloride of gold and cadmium. From the anterior third of the muscles, strips one millimetre thick were cut with scissors; the strips were then left for five minutes in fresh filtered lemon-juice, washed in distilled water, and placed for half an hour in a one-per-cent solution of gold and cadmium, being kept dark; washed again in one-per-cent aqueous solution of formic acid, in which they were left twelve hours in the dark, then twelve in the light; finally, kept in the dark in stronger formic acid for one day, and preserved in glycerine. Such strips may be easily dissociated into fibres.

Two forms of nerve-endings are observed. One, the rarer, represents probably the initial form: it consists of bunches of grains, suspended by peduncles arising by repeated division of the pale fibres towards their termination. The second form has been previously described (*Mem. accad. sc. istit. Bologna*, 1877), but the following new points deserve mention: the end-plate appears to be more closely united to the sarcolemma than to the muscular substance; between the ramifications of the fibres appear certain corpuscles, probably connective tissue, but whether they lie within or without the sarcolemma was not determined; a secondary sheath extends over the primary and secondary, but stops at the tertiary branches; the ultimate terminations are bunches of pedunculated grains, the grains being colored dark, their stalks light; finally, the presence of a granular embedding substance around the nervous branches. — (*Arch. ital. biol.*, iii. 75.) C. S. M. [162

Fishes of the Batstoe River, New Jersey. — Professor E. D. Cope stated that eleven species collected in the confined waters of a broken dam on the Batstoe River, New Jersey, represented the fish fauna of the Carolinian district of the nearctic realm, only three extending into the Alleghanian district. A species of Amiurus new to science was at first supposed to be an unusually dark-colored example of the common Amiurus nebulosus. A critical examination soon showed that it differs in the important characters of the considerably more anterior position of the dorsal fin, four to seven more anal radii, and more rounded outline of the caudal fin. Its characters ally it to the western A. natalis, from which it differs by its more slender form and more rounded caudal fin. The name A. prosthistius was proposed for it. — (*Acad. nat. sc. Philad.; meeting* June 26.) [163

Mammals.

Color-markings of mammals. — Professor Eimer has continued his studies in regard to the color-markings of vertebrates.

As the result of his observations, he has drawn out certain general principles, which he applies to the different groups, notably to the mammals.

The following general statements are elaborated: 1. That the color-markings of mammals may be reduced to longitudinal stripes, spots, and transverse stripes; 2. That the longitudinal stripes are the oldest form, and that the other two follow in course; 3. That the primitive mammalian fauna was a longitudinally striped one; 4. That the males have been first to take on the new forms of markings, while the females hold longer to the older form; 5. That the effects of the law by which the development of the markings takes place from the posterior part of the body toward the anterior part are not so easily traced in mammals as in the case of other groups, such as the saurians; 6. That in mammals the development of markings follows a regular course, that is, the longitudinal markings are followed by spots, which, in turn, run together, and finally form the transverse or tiger stripes; 7. That the position of the smallest spot on a mammal is not accidental, but due to the action of genetic and philogenetic laws, from which it follows that markings are an available means for the determination of species; 8. That the regularity of the development of markings shows that they arise from constitutional causes.

The author takes the Viverridae as the original

types of the carnivores, and believes that in the hyena, cats, dogs, bears, and weasels, he can trace the form and position of markings possessed by the former. He acknowledges several difficulties, however, in the case of the leopard, jaguar, and other peculiarly spotted cats. He believes that the ungulates follow the same law in regard to markings as the carnivores. — (*Jahresh. verein vaterl. naturk. Württ.*, xxxix. 1883. 56.) F. W. T. [164

(*Man.*)

Function of the crico-thyroid muscle. — Martel brings forward some experiments to show that the crico-thyroid, and not the thyro-arytenoid muscle is par excellence the muscle used in the production of different tones in singing and speaking. The most interesting point of the paper, perhaps, is, that he shows, by registering with simple levers the movements of the thyroid and cricoid cartilages respectively, that, when the different chest-notes (from do^2 to do^4) are sounded, the thyroid cartilage remains immovable, while the cricoid is brought closer and closer to it as the pitch of the note is raised. In the contraction of the crico-thyroid muscle, or, as he prefers to call it, the thyro-cricoid muscle, the thyroid cartilage is therefore to be considered as the fixed point. The action of the thyro-arytenoid muscle, according to him, is preparatory to that of the crico-thyroid, in that it gives the vocal cords their proper position, and acts as an antagonist to the latter muscle. The length and tension of the vocal cords, however, are governed by the crico-thyroid. This view of the function of the crico-thyroid is supported by the results obtained when the muscle, or the nerve going to it, is divided in the dog, and, among men, by the pathological cases in which there is paralysis of this muscle. The general result in such cases is a pronounced hoarseness, and an inability to sound any but the lowest tones. — (*Arch. de physiol.*, 1883, 582.) W. H. H. [165

Summation of stimuli in the sensory nerves of man. — From numerous experiments made upon himself with electrical stimuli, de Watteville comes to the conclusion that the action of stimuli applied to a sensory nerve increases, within certain limits, with their frequency. Stimuli which are subminimal, as long as they follow at slow intervals, will call forth a sensation when made to follow each other with greater rapidity. This summation takes place more readily when the stimulated nerve is exposed to the action of the kathode; and the author is of the opinion that it is local, as in motor nerves, and not central. The summation may be explained as the after action of electrical stimulation; the induction shocks following with such rapidity that the excitation in each case falls within the period of heightened irritability. — (*Neurol. centralbl*, no. 7, 1883.) W. H. H. [166

ANTHROPOLOGY.

Tribute to American scholarship. — An interesting tribute to American scholarship is paid in the fact that M. Barbier, on the authority of Mr. Stephens and later writers, was setting up Del Rio's 'images of men in bas-relief' in front of the model of the Temple of the Sun, as he had done in the Trocadero. Dr. Rau of the Smithsonian institution drew his attention to Del Rio's description of the Temple of the Cross, as well as to the statements of Dupaix and Galindo; and the bas-reliefs at Washington will stand in their proper place in front of the shrine containing the group of the Cross. Again, Prof. Cyrus Thomas has discovered that the cast on the left slab of the Tablet of the Cross proves conclusively the correctness of the statement previously made in SCIENCE, that Waldeck's figure of this slab, as published by the French scientific commission, 1860–66, was copied from Catherwood's drawing. This is proved by the fact that Catherwood's errors, of which M. Charnay's cast brings to view quite a number, are all faithfully reproduced in Waldeck. — O. T. M. [167

Prehistoric trepanning. — The object of recalling attention to this much described subject is to speak of the novel experiments of L. Capitan. Many years ago Dr. Charles Rau, wishing to know how long it would take a savage to bore a hole through a hard rock with a wooden spindle, using sand and water, actually made the experiment, and has put on record his experience. M. Capitan has proceeded in the same way respecting prehistoric trephining, testing the various methods of boring and of removing a rondelle or fragment of bone. The experiments on the skulls of the dead were to study the methods, the difficulties in the way of the operation, and the time required. It is the trephining of the living among savages, and the fatality of the result, that most interest the student: therefore M. Capitan continued his researches upon living canine subjects. The first experiment was upon a small spaniel. The skin of the head and temporal muscle were removed, and the trephining was practised upon the antero-superior portion of the right parietal. The operation was not very painful, and in twenty minutes a rondelle of bone was removed. There was little hemorrhage and the meninges were not wounded. After a few days the spaniel was as lively as ever. Two other dogs were subsequently treated, with like success. Just what the method and amount of cicatrization might be, after such primitive operations, will be known when the autopsy of the subjects takes place in the future. — (*Bull. soc. anthrop. Paris*, v. 535.) J. W. P. [168

Catlinite. — The beautiful red stone pipes in collections of Indian culture-objects are made of a stone called catlinite. Mr. E. A. Barber tells us that for many generations the aborigines have procured this material from the Great red pipestone quarry, situated on the dividing-ridge between the Minnesota and Missouri rivers, at a place called by the French *Couteau des prairies*. Catlin, the celebrated traveller, was the first white man permitted by the Indians to visit the place; and therefore Dr. C. T. Jackson, to whom specimens were sent, named the mineral catlinite. The myths relating to the quarry, as well as surface indications, show that the place has been worked for a very long time. In 1673 Marquette smoked in peace a catlinite pipe with the Indians of the upper Mississippi. Father Hennepin applies the term 'calumet' to these ceremonial pipes. There is no

doubt that an extensive traffic was carried on in this material for a considerable length of time by the aboriginal tribes, extending from the Atlantic coast to the Rocky Mountain system and from New York and Minnesota on the north to the Gulf of Mexico. The fact that objects of catlinite have been taken from Indian graves in the state of New York, and that others were found on the ancient site of an abandoned village in Georgia, at opposite points twelve hundred miles distant from the pipestone quarry of Minnesota, reveals the great extent of intercommunication which formerly existed among the North American peoples. When we consider that many pipes of catlinite have been taken from the bottom of mounds from four to seven feet deep, where they were found in connection with cloth-wrapped copper axes and many other objects of high antiquity, and that some of them are of the typical form of the oldest mound-pipes, we are forced to ascribe to some of them a high antiquity. — (*Amer. nat.*, July.) J. W. P. [169

The Charnay collection. — Visitors to the National museum at Washington are surprised to find the great hall adjoining the last doorway on the south side shut off by screens. Looking behind this barricade, the visitor may imagine himself transported to Central America, and in the presence of some of her grandest aboriginal remains. Here M. Barbier, from the Trocadero museum at Paris, is setting up casts of the most celebrated relics of Mexican and Central American ruins secured by M. Charnay. The readers of SCIENCE will recall that Mr. Pierre Lorillard of New York, conjointly with the French government, equipped an expedition in 1880, and maintained it for two years, for a systematic investigation of the so-called 'ruined cities' and other remains of ancient civilization in Central America and Mxeico. The expedition was placed under the charge of M. Désiré Charnay, and thoroughly furnished with the means of making photographs and casts by the process of M. Lotin de Laval. Copies of these casts were first to be presented to the Smithsonian institution and to the French government, the latter set to be placed in the Trocadero museum at Paris. The story of M. Charnay's travels and successes has been told in the *North American review*, commencing with August, 1880; the editor, Mr. Thorndike Rice, favoring and encouraging the expedition from the first. M. Charnay's moulds having been transported to Paris, he proceeded to make his reproductions. With reference to the Smithsonian series, now being set up in the National museum, Mr. Rice writes, "These casts are duplicates of those now on permanent exhibition at the Trocadero, Paris. The casts have been made in order to afford to students of American antiquities the fullest opportunity for studying these products of indigenous art and the hitherto indecipherable inscriptions." The collection includes a bas-relief from Ocosingo, the stone of Tizoc, fragment from Tezcuco, thirty-eight pieces from Palenque, including the most celebrated sculptures and inscriptions, and thirty-four pieces from Chichen-Itza. M. Hamy will shortly send a detailed account of each piece, and the readers of SCIENCE will receive the benefit of his information. Professor Baird will have the bas-reliefs of the Temple of the Sun and those of the Temple of the Cross mounted in wooden frames, the exact reproduction of the rooms which they occupied in Palenque. — J. W. P. [170

EARLY INSTITUTIONS.

The Nottingham records. — The records of the borough of Nottingham have been published by Quaritch in London. They cover the period from 1155 to 1399, and contain much interesting matter bearing upon the history of town customs and government in England. Mr. G. L. Gomme, the author of Primitive folk-moots, reviews the volume, and gives us some extracts from it. Assuming that the municipal corporation of the thirteenth century is the primitive village community in a late stage of development, he discovers various customs which he describes as belonging to the primitive village. The history of the primitive village is in this way extended and enlarged. Some very interesting passages, illustrative of the right of pre-emption which kinsmen enjoyed, are given. It appears, that, "if a person sold his land [in Nottingham], his nearest heirs might lawfully enter into such lands and tenements if they offered to the purchaser, in the gild hall of the town, the money which he had given for the property." Some passages bearing upon the history of the open-field system are also cited. Mr. Gomme regards the open-field system as 'the best evidence of the old primitive tenure of land.' The custom of borough English — or 'junior-right,' as Mr. Elton calls it — obtained at Nottingham. — (*The antiquary*, April, 1883.) D. W. R. [171

NOTES AND NEWS.

It is hoped that the new section for mechanics of the American association for the advancement of science will receive the earnest co-operation of all interested, who may find it convenient to attend. The approaching meeting at Minneapolis will be the second held by the section. Those having matters of interest to present are requested to notify the secretary of section D (A. A. A. S.) at Minneapolis as early as possible. Circulars relating to the meeting may be obtained of the permanent secretary of the association, F. W. Putnam, at Minneapolis.

— During the coming year, experiments will be made at the physical laboratory of Johns Hopkins university with a view to aid in establishing an international unit of electrical resistance. The experiments will be carried on, under the direction of Professor Rowland, with an appropriation from the government of the United States. The results will be communicated to the International commission of electricians, meeting in Paris.

— We alluded a few weeks ago to the award of the first Walker prize of the Boston society of natural history to Mr. Howard Ayres of Fort Smith, Ark., for his memoir on the development of Oecanthus. This memoir is now printing by the society. The award of the second prize has now been made. Several papers of unquestionable merit were before the

committee, and the subjects were so diverse as to make it difficult to decide between them. Expert aid was sought; and it has been at last concluded to divide it equally between William Patten of Watertown, Mass., who offered an essay on the development of Phryganidae, and H. W. Conn of Johns Hopkins university, who presented an essay on the life-history of Thalassema millita.

— Recognizing the demand for thoroughly trained engineers conversant with electrical science, at the beginning of the next academic year (Sept. 18, 1883) the trustees of Cornell university will receive students who desire to fit themselves to enter this new and constantly extending field. While the general studies are mainly those of the departments of civil and mechanical engineering, the special studies of the course embrace the theory of electricity, the construction and testing of telegraph lines, cables, and instruments, and of dynamo machines, and the methods of electrical measurement, electrical lighting, and the electrical transmission of power.

— During the past year original investigations, the results of which either have been or soon will be published, have been made in the biological laboratory of Johns Hopkins university, in the following subjects: the direct action upon the heart of ethyl alcohol, the influence of digitaline upon the heart and blood-vessels, the influence of quinine upon the blood-vessels, the influence of variations in arterial pressure upon the time occupied by the systole of the heart, the minute structure of the kidney, the life-history of Penicillium, viscous fermentation, the influence of various illuminations on the growth of yeast, the structure of Porpita, the structure of the gasteropod gill, the development of the mammary gland, the structure and properties of the cavernous tissue beneath the olfactory mucous membrane.

— The U. S. geological survey has appointed Prof. H. S. Williams of Cornell university upon its staff. Under its auspices he will carry out more fully the studies he has long undertaken upon the upper Devonian fossils of the rich localities of his neighborhood in New York, and extend the work beyond the limits of the state, as well as into the immediately underlying and overlying strata, for better comparison of the upper Devonian species, and study of their faunal relations. Professor Williams has been endeavoring to build up a thorough school of comparative paleontology at Cornell with good success; and the assistance he will gain from his connection with the U. S. survey will offer a special attraction to those wishing to pursue paleontological studies under him. Mr. C. S. Prosser, a recent graduate of Cornell, assists him this summer in his geological work in connection with the U. S. survey.

— A very interesting sketch of the life of Count Rumford, by Professor Tyndall, is printed in the *Contemporary review* for July. An account of his scientific labors is promised in a future issue.

— W. H. M. Christie, F.R.S., astronomer royal, has withdrawn from the editorship of *The observatory*, a monthly review of astronomy. This periodical will now be edited by E. W. Maunder, F.R.A.S.; and all communications should be addressed to him at the Royal observatory, Greenwich, as formerly.

— Dr. M. Braun in Dorpat proposes a zoölogical investigation of the Gulf of Finland. The Russian government will furnish a steamer, and the explorations are to be made on behalf of the Naturalists' society of Dorpat.

— The *American apiculturist* is the ninth periodical in the United States devoted to bees and apiculture. Several of these papers have a circulation numbering thousands, and one is a weekly. It would seem rash to start another bee paper under these circumstances. Silas M. Locke, editor of this new journal, seems, however, to have counted the cost, and means to act on the principle that there is always room up higher. He is an experienced bee-keeper, and expert in all the manipulations of the apiary. He has paid special attention to the qualities of the several races of bees, and is alive to the importance of great care in breeding bees, if the apiarist would secure the highest success. It is evident that he intends to give special attention to matters of scientific interest connected with bees and bee-culture.

Mr. Locke has also secured the assistance of the ablest writers on the apiary in the country, — not men who are simply given to fine writing, but practical men, who have won eminent success in the art which they practise. The paper is published at Salem, Mass., and, in typography and general style, has no superior among our apiarian periodicals.

— According to *Nature*, the report of the sanitary commissioner with the government of Bombay shows, that, among other causes of death in that presidency in the year 1881, 1,209 persons died from snake-bite. A comparison of the deaths in 1881 with the mean of those of five preceding years shows, that, in 1881 at least, the number had increased. These figures prove that one person in 13,610 of the whole population of the twenty-four presidency districts died from snake-bite. Adding to this the destruction of human life effected by other venomous and carnivorous animals, we see how important a matter to the residents of those regions is the destruction of this unfavorable environment.

— All the readers of SCIENCE have been familiar with the word 'wampum' from their childhood. Roger Williams wrote in his Key, "The New-England Indians are ignorant of Europe's coyne. Their owne is of two sorts, — one white, which they make of the stem or stock of the periwincle, which they call meteauhok when all the shell is broken off. This they call *wampam* (white). The second is black, inclining to blue, which is made of the shell of a fish which some English call hens (poquahock)." This money was called suckauhock (*sucki*, black). Various shells were used in different parts of the country under names adopted from the languages of the tribes who coined the money. But in the history of the early colonies the name 'wampum' has gained a footing for all shell-money as well as for its imitations. Mr. Earnest Ingersoll has brought together a large amount of information on the subject in the May *Naturalist*.

— The death is announced of E. Mohler, secretary of the Danube commission, and of Hermann Alexander von Berlepsch of Zurich, the latter in his seventy-first year.

— The death is also announced of Dr. J. S. Bailey of Albany, a young entomologist who had published a few papers of some importance on Lepidoptera.

— In the June number of the *Journal of science* is given the following account of a bird-eating frog. "A lady living in the George district (Cape Colony) supplies the *G. R. herald* with the following particulars of the remarkable habits of this creature: 'I have much pleasure in furnishing all the information we have, regarding the large frogs which have proved so destructive to our young chickens. A water-sluit runs round our terrace, and passes through the ground over which the poultry range, and in this the frogs harbor. The first time our attention was drawn to their bird-eating propensity was by the cries of a small bird in a fuchsia near the stream. Thinking it had been seized by a snake, several hastened to the spot, and saw a beautiful red and green sugar-bird in the mouth of a large greenish frog. Only the bird's head was visible; and, its cries becoming fainter, the frog was killed, and the bird released. Its feathers were all wet and slimy, and for some days after we could distinguish it in the garden by its ruffled plumage. Since then the same species of frog has on several occasions been killed with young chickens, half-swallowed; and once a duckling was rescued from the same fate. Whether the noise is natural to these frogs, or assumed to decoy the chickens within their reach, we know not; but they constantly make a chuckling sound so exactly like a hen calling her chickens for food that we have seen whole broods deceived, and rushing towards the sluit, where they supposed the hen to be. The frogs are very wary, and it is difficult to find them unless by the screams of their victims. We have lost large numbers of small chickens in an unaccountable manner, and feel sure now that these frogs must be answerable for very many of them, as there are no rats here, and the chickens are carefully housed at night. If I can give you any further details, I shall be glad to do so.'"

— The distinguished spectroscopist, M. Thollon, is now working at the observatory at Paris, as has been his custom during previous summers. The proposed observatory on the top of the Pic du Midi — where the brothers Henry saw the planet Venus with the naked eye in full daylight, when only three or four degrees from the sun, and two days after the transit — is said to be making great progress toward completion. It is expected that Admiral Mouchez, M. Thollon, and other astronomers will visit it toward the end of August.

— The *Vierteljahrsschrift der astronomischen gesellschaft* (18 jahrgang, erstes heft) is frontispieced with a solar print of Dr. Carl Christian Bruhns, the late director of the observatory at Leipzig. In the *nekrologe* are brief notices of Bruhns and C. Baeker, and a more extended one of E. Plantamour, by Dr. Rudolph Wolf of Zurich. Among the *literarische anzeigen* are the following: Backlund, Zur theorie des Encke'schen cometen, by Paul Harzer; Callandrean, Détermination des perturbations d'une petite planète par les méthodes de M. Gyldén, by O. Backlund; Ginzel, Astronomische untersuchungen über finsternisse, by Th. von Oppolzer; and Fischer, Der einfluss der lateralrefraction auf das messen von horizontal-winkeln, by Wilhelm Schur. Among the newly elected members of the *gesellschaft* are P. Harzer of Leipzig, J. Holetschek of Vienna, J. Scheiner of Bonn, and C. Wagner of Kremsmünster. The next meeting of the *gesellschaft* will be held at Vienna, commencing on Friday, Sept. 14, and lasting four days.

— The geological commission of Spain has prepared a pamphlet of twenty pages for the mineral exhibition, now open at Madrid, giving a brief account of the different geological formations occurring in Spain, their geographical distribution, general characters, and the minerals of economic interest occurring in each. It also gives a short orographical account of the country, which has a higher average elevation than any country in Europe excepting Switzerland. The highest peak is that of Mulahacen, in the Sierra Nevada, 3,554 metres above the sea-level. The formation which has the greatest extent in Spain is the tertiary, which covers 34 per cent of the surface; next comes the primary, covering 27 per cent; the secondary, 18½ per cent; the hipogenica, 10 per cent; the quaternary, 10 per cent; and the azoic, ½ per cent. Given in numerical order, the miocene and oligocene cover together 137,877 □ kilom.; the Cambrian and Silurian, 114,382; the hipogenica, 49,665; the quaternary, 49,477; the cretaceous, 47,002; the eocene, 23,564; the Jurassic, 22,697; the triassic, 22,443; the carboniferous, 11,301; the pliocene, 9,064; the Devonian, 5,780; and the crystalline strata, 1,694, — a total of 494,946 □ kilom. The term '*rocas hipogenicas*' is applied to what are generally called plutonic and volcanic rocks, both old and recent eruptive rocks.

— Père Vidal, French missionary at Tutuila, Navigator's Islands, announces the discovery, made last year, of the place of burial of Commandant Fleuriot de Langle, of the unfortunate expedition of la Perouse. De Langle and his companions were killed by the natives at a point named Massacre Bay, in December, 1787; but up to this recent date their remains and place of burial had not been discovered. The pious missionary intends to erect an expiatory chapel for the converted natives on the spot where their barbarous ancestors' victims were buried.

— Mr. Henry H. Howorth, who is our standard authority on the Mongols, reviews with favor the work of the Rev. James Gilmour, who has lived as a missionary among them. We have space only for a brief abstract upon the hospitality of these least sophisticated tribes of men: "Any traveller is at perfect liberty to alight at any village he may wish, and demand admittance; and any Mongol who refuses admittance, or gives a cold welcome even, is at once stigmatized as not a man, but a dog. Any host who did not offer tea without money and with-

out price would soon earn the same reputation; the reason being, I suppose, that Mongolia has no inns, and all travellers are dependent on private houses for shelter and refreshment. At first sight it seems rather exacting to leap off your horse at the door of a perfect stranger, and expect to find tea prepared and offered to you free; but probably the master of the tent where you refresh yourself is at the same time sitting likewise, refreshing himself in some other man's tent some hundred miles away; and thus the thing balances itself. The hospitality received by Mongols in travelling compensates for the hospitality shown to travellers."

— Two noteworthy ornithological papers appear in the August magazines. The habits and mental traits of the cat-bird in confinement have found an excellent student in Olive Miller, who gives us in the *Atlantic* a vivid picture of its curiosity, and its tyranny over weaker birds, with proofs of how it can learn by experience, and its capacity for jealousy. The article is well worth reading.

The friends of Prof. A. M. Meyer of Hoboken, who are aware of his zeal as a sportsman, will be less surprised than those who know him only by his professional studies, at his interesting paper on the quail, or 'Bob White' as it is familiarly known, which appears as the leading paper in the midsummer *Century*. Eight or nine exquisite woodcuts by Beard illustrate the different species of this class of game-birds in Europe and America, and far surpass in finish, and in excellence of delineation, any previous pictures we have seen.

— An increased interest in economic entomology is being shown in England. The Council of education (My lords of the privy council) have formed a committee of advice and reference regarding the entomological collections which have existed for some time in connection with South Kensington museum. This committee is under Professor Huxley as chairman; and among the members are Professor Westwood, Mr. Dyer (sub-director at Kew gardens), and Miss Ormerod. It is planned to form a collection of cases that shall show the insects commonly injurious to a serious extent to the crops, fruit and timber trees, of the British Isles. Each case is to be accompanied by short life-histories of the species in it, and descriptions of the most serviceable methods of preventing their ravages. It is the purpose of the committee to make the collection thoroughly plain to be understood, so that farmers and gardeners may be able to consult it serviceably. As far as possible, the insects will be shown in all stages, together with specimens of the injured plant. In those cases where specimens are too small or too perishable to be used, drawings or models will be substituted. The carrying-out of this plan in a thoroughly scientific manner has been assured by placing the preparation of the cases in the hands of Professor Westwood and Miss Ormerod.

— In order to bring together the greatest amount of solid information respecting the natural history of man, students have published manuals of anthropology from time to time, formulating the questions they desire to have answered. In 1800 Degeraudo, a member of the Institut de France, published a quarto of fifty-seven pages, entitled 'Considérations sur les diverses méthodes à suivre dans l'observation des peuples sauvage.' The Société ethnologique de Paris, in 1839, published its first memoir, which was preceded by general instructions addressed to travellers, among which were three chapters on the individual, family, social, and religious life of peoples. Mr. Gallatin, in our own country, while preparing his comparative Indian linguistics, issued circulars to all army officers, Indian agents, and travellers. Mr. Schoolcraft prepared a very elaborate scheme. George Gibbs published through the Smithsonian institution a linguistic circular, and the same institution has issued a number of others on anthropological subjects. The most elaborate published in our country are Major Powell's manual for collectors of linguistics, and Professor Mason's directions to collectors for the Centennial exhibition, and his pamphlet on the study of North American antiquities. In 1875 the Geographical society of Paris published 'Instructions aux voyageurs.' The British association have printed three sets of questions, in 1851, 1854, and in 1874. The last named bears the title 'Notes and queries on anthropology for the use of travellers and residents in uncivilized lands.' The Austrian expedition in the frigate Novara was furnished with a very elaborate volume of questions upon anthropology. In addition to these, we have 'Instructions anthropologiques' and 'Instructions craniologiques' by the Paris society, and manuals by Roberts and Kaltbrunner. Finally, the last-named society has been discussing with much learning and a slight loss of temper a 'Questionnaire de sociologie et d'ethnographie.'

— The following investigations have been completed by advanced students at the chemical laboratory of Johns Hopkins university during the past year: on the conduct of moist phosphorus and air towards carbon monoxide; white phosphorus; oxidation of a compound containing the sulphamine and propyl groups in the ortho-position with reference to each other, showing protection of the propyl; oxidation of paradipropylbenzine-sulphamide, showing protection of the propyl; on the nature of sinapic acid; the influence of light on fermentation; chemical examination of minerals from the neighborhood of Jones's Falls.

— Regarding the early telescopic observations of the ring of Saturn, DR. H. G. van de Sande Bakhuyzen, the director of the observatory at Leiden, writes to the editor of *The observatory:* It is clear that Bell is not the discoverer of the division of Saturn's ring; but that Cassini ought to be accounted the discoverer is not quite so certain. In a volume of MS. observations by Huygens, in the library of the university of Leiden, there is a drawing of Saturn, made 1675, Dec. 8 (and which has been copied, and published by Kaiser in 1855), wherein the division in the ring, and the difference of brightness of the two parts, are clearly indicated. Above and on the side of the drawing, Huygens wrote, among other things, ". . . Saturnus cum comite observatus tubo 36 pedum Campani;

aderat de Cassinius. . . . [A description of the ball and the ring as seen by the observer here follows, and succeeding the words] quod a Josepho Campano jam olim observatum, ut figura ab ipso edita comprobat. . . ." When Huygens made this observation, Cassini was with him; but, from the notice in the *Philosophical transactions*, it is probable that Cassini saw the division of the ring in August or September, 1675; so that there is no sufficient ground to think that it was Huygens who showed the division to Cassini. But with regard to the allusion of Huygens to the observation of the two parts of the ring, made by Campani, and the figure of the same which he had published, Dr. Bakhuyzen searched in vain in different books for the figure until he found, between a number of letters addressed to Huygens from Leopold, Prince of Etruria (the same to whom Huygens dedicated his 'Systema Saturnium'), a sheet of paper with two printed drawings of Saturn and Jupiter. The details in the belts of the latter planet show that Campani's telescope was a very good one. The shadow of the ring is to be seen on the disk of Saturn; and the outer part of the ring, for somewhat less than half the total breadth, is dotted, whilst the inner part is bright. There is no line between the two parts, but they are distinctly separated from one another by the difference in brightness. One can also see traces of the inner dark ring. It is highly probable that the above words of Huygens refer to this figure of Saturn; and Dr. Bakhuyzen therefore concludes that Joseph Campani was the first astronomer who, by means of a very good telescope made by himself, saw distinctly the darker and the brighter part of the ring in 1664. It is, however, possible that Cassini was the first who saw the line of separation. The drawings of Saturn and Jupiter made by Campani are printed in 'Stanislai Lubiensecii de Lubienietz Theatrum Cometicum,' Pars prior, page 574. Lubienietz received the drawings from Athanasius Kircher in Rome.

— The proprietors of the *Melbourne age* have sent an exploring expedition to New Guinea.

— In the *Proceedings of the American philosophical society* (xx. no. 113) Professor Pliny Earle Chase has a long paper, thirty-three pages, on 'photodynamics,' in which, starting with 'combined cometary harmonics,' he comes out at 'lines of force and of motion;' and Professor George F. Barker gives an account of his very simple form of constant battery.

— The aeronautical exhibition was held in Paris, at the Palais du Trocadéro, from June 5 to 24, — one week longer than was the intention. There were a number of plans for flying-machines shown, but a strange lack of successful results.

RECENT BOOKS AND PAMPHLETS.

**** *Continuations and brief papers extracted from serial literature without repagination are not included in this list. Exceptions are made for annual reports of American institutions, newly established periodicals, and memoirs of considerable extent.*

Adams, R. C. Evolution; a summary of evidence: a lecture delivered in Montreal, March, 1883. New York, *Putnam*, 1883. 44 p. 12°.

Amsterdam. — Wiskundig genootschap. Catalogus der bibliotheek. Amsterdam, *Sikken*, 1883. 8+112 p. 8°.

Béguyer de Chancourtois. Questions de géologie synthétique; études, documents et modèles exposés à l'exposition de 1883 à Madrid. Paris, *impr. nat.*, 1883. 27 p. 8°.

Bentley, R. The student's guide to structural, morphological, and physiological botany. London, *Churchill*, 1883. 490 p. 12°.

Bernard, G. Champignons observés à La Rochelle et dans les environs. Paris, *Baillière*, 1883. 300 p., 56 pl., atlas. 8°.

Boulnois, H. P. The municipal and sanitary engineer's handbook. London, *Spon*, 1883. 398 p. 8°.

Boussinesq, J. Cours d'analyse infinitésimale de l'Institute industriel du Nord. Lille, *Danel*, 1883. 28+254 p. 4°.

Carr, H. Our domestic poisons; or the poisonous effects of certain dyes and colors (especially those containing arsenic) used in domestic fabrics. London, *Ridgway*, 1883. 47 p. 8°.

Carton. Solutions raisonnées des exercises de géométrie contenus dans les deux cours de M. l'abbé Carton, professeur de mathématiques à l'institution Notre-Dame à Valenciennes. Paris, *Poussielgue*, 1883. 312 p. 12°.

Cassé, E. Aérostation pratique; épure et construction des aérostats et montgolfières, avec quatre planches explicatives. Paris, *Hennuyer*, 1883. 41 p. 8°.

Crié, L. Cours de botanique: organographie et familles naturelles pour la classe de quatrième, les écoles normales et les écoles d'agriculture. Paris, *Doin*, 1883. 12+481 p., 865 fig. 18°.

Daguillon. Entre vignerons à la veillée, causeries sur la culture de la vigne, la vinification et la conservation du vin. Clermont-Ferrand, *impr. Mont-Louis*, 1883. 463 p. 18°.

Davy, G. Tout par l'électricité. Tours, *Mame*, 1883. 475 p. 8°.

Dubois, A. Histoire naturelle vulgarisée, ornithologie populaire; grand et petite rapaces, oiseaux chasseurs. Limoges, *Barbou*, 1883. 124 p. 12°.

—— *The same.* Oiseaux fantastiques et oiseaux chasseurs. Limoges, *Barbou*, 1883. 125 p. 12°.

Duclau, S. La science populaire: les ballons et les premiers voyagers aériens. Limoges, *Ardant*, 1883. 143 p. 12°.

Fontannes, F. Note sur la découverte d'un Unio plissé dans le miocène du Portugal. Paris, *Savy*, 1883. 24 p., pl. 8°.

Graeff, A. Traité d'hydraulique, précédé d'une introduction sur les principes généraux de la mécanique. 3 vol. tom. i.: partie théorique, 8+333 p.; tom. ii.: partie pratique, 541 p.; tom. iii.: tables numériques, notes, errata, planches, 52 p. Paris, *impr. nat.*, 1883. illustr. 4°.

Herrick, C. L. Types of animal life, selected for laboratory use in inland districts. pt. i.: Arthropoda. Minneapolis, *Kimball pr.*, 1883. 33 p., [7] pl. 8°.

Holmes, A. Bromley. Practical electric lighting. New York, *Spon*, 1883. 154 p., illustr. 8°.

Johnston's new map of South Africa, with index. London, *Johnston*, 1883.

Lalande, J. de. Tables de logarithmes pour les nombres et pour les sinus. Revues par le baron Reynaud. Édition stéréotype, augmentée de formules pour la résolution des triangles, par M. Bailleul, typographe, et d'une nouvelle introduction. Paris, *Gauthier-Villars*, 1883. 42+236 p. 16°.

Lambert, J. The germ theory of disease concisely and simply explained. London, *Baillière*, 1883. illustr.

Lyras de Moléon. La mer, description de ses merveilles, ses curiosités les plus remarquables. Limoges, *Ardant*, 1883. 144 p. 12°.

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